

EXHIBIT B

(12) **United States Patent**
Jobs et al.

(10) **Patent No.:** **US 7,479,949 B2**
(45) **Date of Patent:** ***Jan. 20, 2009**

(54) **TOUCH SCREEN DEVICE, METHOD, AND GRAPHICAL USER INTERFACE FOR DETERMINING COMMANDS BY APPLYING HEURISTICS**

(65) **Prior Publication Data**
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Related U.S. Application Data

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(51) **Int. Cl.**
G09G 5/00 (2006.01)
G06F 3/048 (2006.01)
(52) **U.S. Cl.** **345/173; 345/169; 715/786; 715/784**
(58) **Field of Classification Search** **345/156, 345/157, 173-181**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,528,260	A *	6/1996	Kent	345/684
5,655,094	A *	8/1997	Cline et al.	715/786
5,805,161	A *	9/1998	Tiphane	715/786
6,278,443	B1	8/2001	Amro et al.	345/173
6,466,203	B2	10/2002	Van Ee	345/173
6,559,869	B1 *	5/2003	Lui et al.	715/785
6,597,345	B2 *	7/2003	Hirshberg	345/168
6,657,615	B2	12/2003	Harada	345/173
6,683,628	B1 *	1/2004	Nakagawa et al.	715/799
6,690,387	B2	2/2004	Zimmerman et al.	345/684
7,088,344	B2	8/2006	Maewawa et al.	345/173
7,093,203	B2	8/2006	Mugura et al.	715/864
2002/0158838	A1	10/2002	Smith et al.	345/156
2003/0184593	A1	10/2003	Dunlop	345/810
2004/0012572	A1	1/2004	Sowden et al.	345/173
2004/0021676	A1	2/2004	Chen et al.	345/684
2004/0160420	A1	8/2004	Baharav	345/173
2005/0012723	A1	1/2005	Pallakoff	345/173
2005/0193351	A1	9/2005	Huoviala	715/840

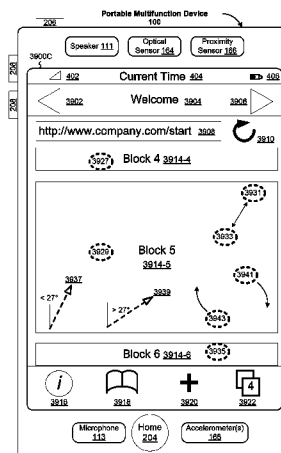
(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **12/101,832**

(22) Filed: **Apr. 11, 2008**



US 7,479,949 B2

Page 2

2006/0001652	A1	1/2006	Chiu et al.	345/173
2006/0007178	A1	1/2006	Davis	345/173
2006/0022955	A1	2/2006	Kennedy	345/173
2006/0028428	A1	2/2006	Dai et al.	345/156
2006/0031786	A1	2/2006	Hillis et al.	715/863
2006/0044259	A1	3/2006	Hotelling et al.	345/156
2006/0049920	A1	3/2006	Sadler et al.	340/407.1
2006/0101354	A1	5/2006	Hashimoto et al.	715/863
2006/0132460	A1	6/2006	Kolmykov-Zotov et al. .	345/173
2006/0164399	A1	7/2006	Cheston et al.	245/173
2006/0181519	A1	8/2006	Vernier et al.	345/173
2006/0253793	A1	11/2006	Zhai et al.	715/773
2006/0294472	A1	12/2006	Cheng et al.	715/771
2007/0040812	A1	2/2007	Tang et al.	345/173
2007/0061126	A1	3/2007	Russo et al.	713/24
2007/0118400	A1	5/2007	Morita et al.	705/2
2007/0120834	A1	5/2007	Boillot	345/173
2007/0130532	A1	6/2007	Fuller et al.	715/764
2007/0150826	A1	6/2007	Anzures et al.	715/772
2007/0152984	A1	7/2007	Ording et al.	345/173
2007/0177803	A1	8/2007	Elias et al.	382/188

FOREIGN PATENT DOCUMENTS

EP	0 827 064	A2	3/1998
EP	0 827 094	A2	3/1998
EP	1 517 228	A2	3/2005
GB	2 347 200	A	8/2000
WO	WO 02/01338	A1	1/2002
WO	WO 2004/111816	A2	12/2004
WO	WO 2005/074268	A1	8/2005
WO	WO 2006/020305	A2	2/2006
WO	WO 2006/126055	A2	11/2006

OTHER PUBLICATIONS

Examiner's Report on Australian Innovation Patent No. 2008100179, dated Apr. 30, 2008, which application claims priority to U.S. Appl. No. 60/824,726, the same priority application of the instant application.

Baguley, R., "Nokia Handhelds & Palmtops Internet Tablet 770, Nokia's Small, Svelte, Internet-Savvy PDA," Jan. 31, 2006, <http://www.pcworld.com/printable/article/id,124456/printable.html>.

Bordovsky et al., "Interpreting Commands from a Graphical User Interface," reproduced from International Technology Disclosures, vol. 9, No. 6, Jun. 25, 1991, 1 page.

Cheng et al., "Navigation Control and Gesture Recognition Input Device for Small, Portable User Interfaces," Synaptics Inc. of San Jose, California, pp. 1-13, 2004.

Computergram International, "Next-Generation Sharp Organizer to carry Pen Interface," No. 1955, Jul. 2, 1992.

Electronic Engineering Times, "Screen Can Tell Finger From Stylus," No. 858, Jul. 24, 1995, p. 67.

Gillespie, D., "Novel Touch Screens for Hand-Held Devices," Information Display, vol. 18, No. 2, Feb. 2002, 5 pages.

Hoover, J.N., "Computer GUI Revolution Continues with Microsoft Surface's Touch Screen, Object Recognition," Information Week, May 30, 2007, <http://www.informationweek.com/story/showArticle.jhtml?articleID=199703468>.

IBM, "Method to Disable and Enable a Touch Pad Pointing Device or Tablet Input Device Using Gestures," Jun. 11, 2002, pp. 1-3.

Johnson, R.C., "Gestures Redefine Computer Interface," Electronic Engineering Times, No. 924, p. 42(1), Oct. 21, 1996.

Korpela, J., "Using Inline Frames (iframe elements) to Embed Documents into HTML Documents," (Online), Sep. 25, 2006, <http://web.archive.org/web/20060925113551/http://www.cs.tut.fi/~jkorpela/html/iframe.html>.

Narayanaswamy, et al., "User Interface for a PCS Smart Phone," Multimedia Computing and Systems, IEEE Conference 1999, Published Jun. 7-11, 1999, vol. 1, pp. 777-781.

Poon et al., "Gestural User Interface Technique for Controlling the Playback of Sequential Media," Xerox Disclosure Journal, vol. 19, No. 2, Mar./Apr. 1994, pp. 187-190.

PR Newswire, "FingerWorks Announces a Gestrue Keyboard for Apple PowerBooks," Jan. 27, 2004, 2 pages.

PR Newswire, "FingerWorks Announces the ZeroForce iGesture Pad," Feb. 18, 2003, 2 pages.

International Search Report and Written Opinion for International Application PCT/US2007/088885, mailed Apr. 24, 2008.

Examiner's Report on Australian Innovation Patent No. 2008100179 dated Apr. 30, 2008.

"Sprint Power Vision Smart Device Treo™ 700p by Palm," Sprint Nextel, 432 pages, 2006.

"Google Maps API—Google Code," Google Inc., <http://www.google.com/apis/maps>, 1 page, printed Apr. 10, 2008.

* cited by examiner

Primary Examiner—Duc Q Dinh

(74) Attorney, Agent, or Firm—Morgan, Lewis & Bockius LLP

(57)

ABSTRACT

A computer-implemented method for use in conjunction with a computing device with a touch screen display comprises: detecting one or more finger contacts with the touch screen display, applying one or more heuristics to the one or more finger contacts to determine a command for the device, and processing the command. The one or more heuristics comprise: a heuristic for determining that the one or more finger contacts correspond to a one-dimensional vertical screen scrolling command, a heuristic for determining that the one or more finger contacts correspond to a two-dimensional screen translation command, and a heuristic for determining that the one or more finger contacts correspond to a command to transition from displaying a respective item in a set of items to displaying a next item in the set of items.

20 Claims, 293 Drawing Sheets

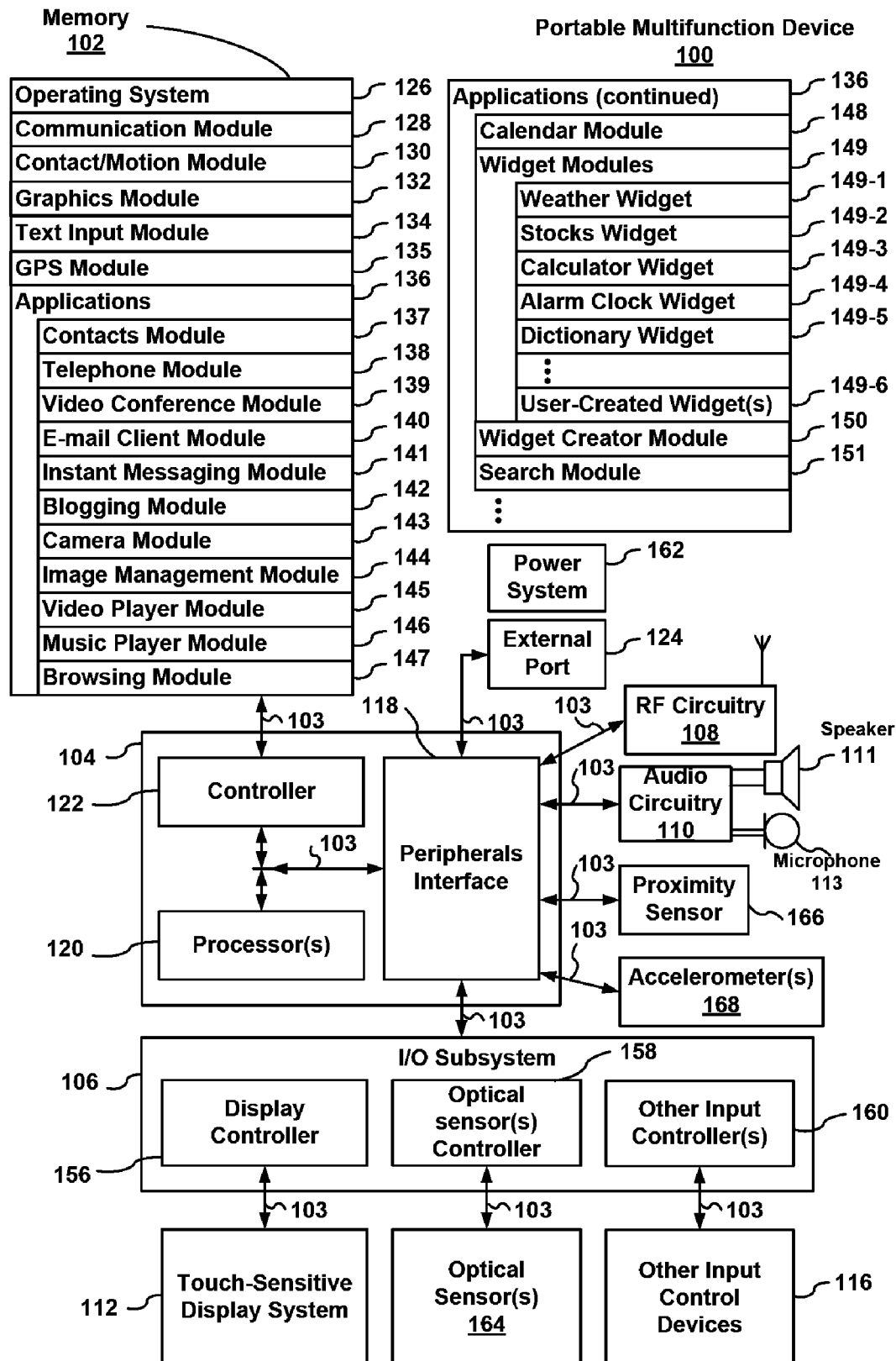


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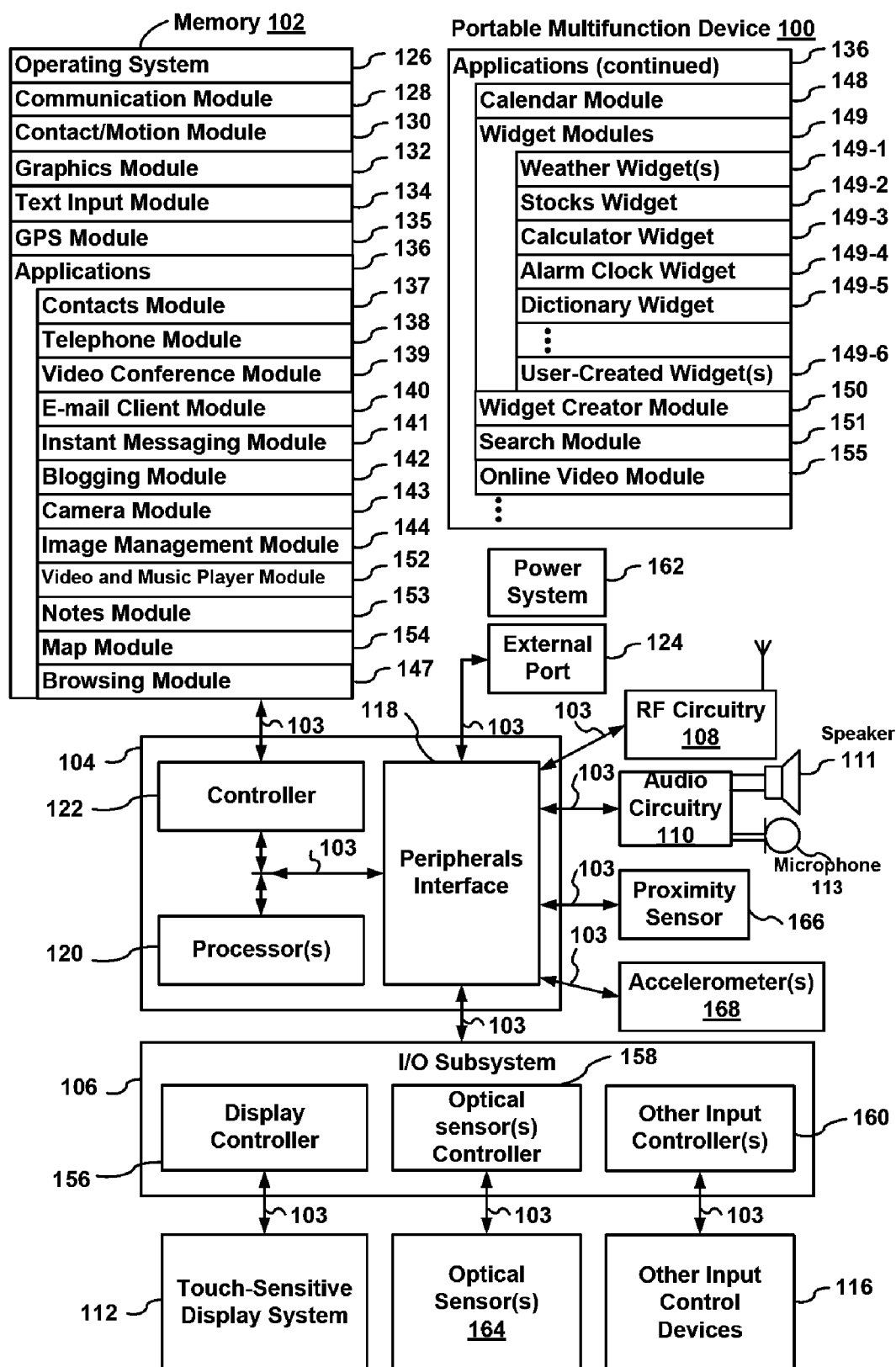


Figure 1B

U.S. Patent

Jan. 20, 2009

Sheet 3 of 293

US 7,479,949 B2

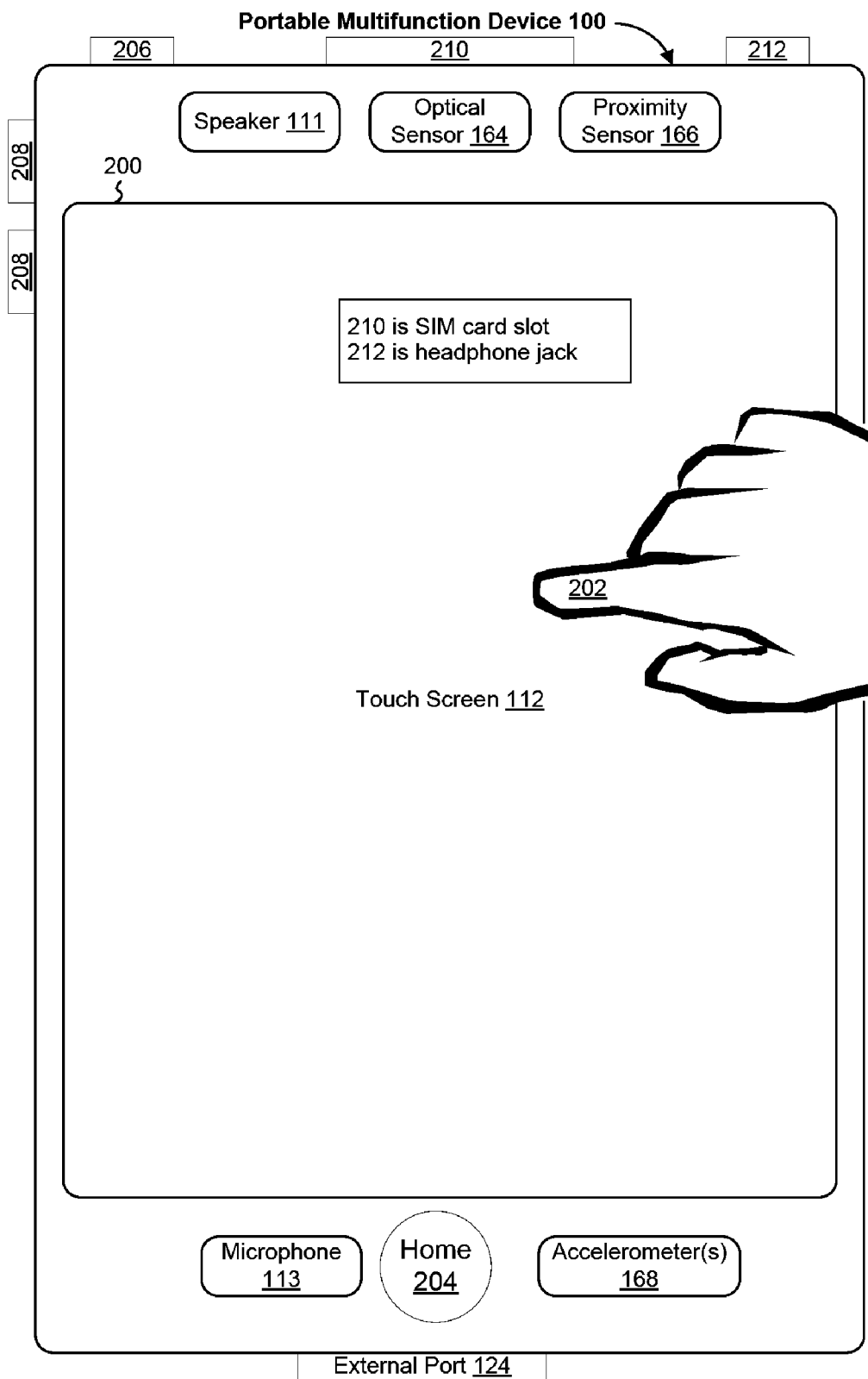


Figure 2

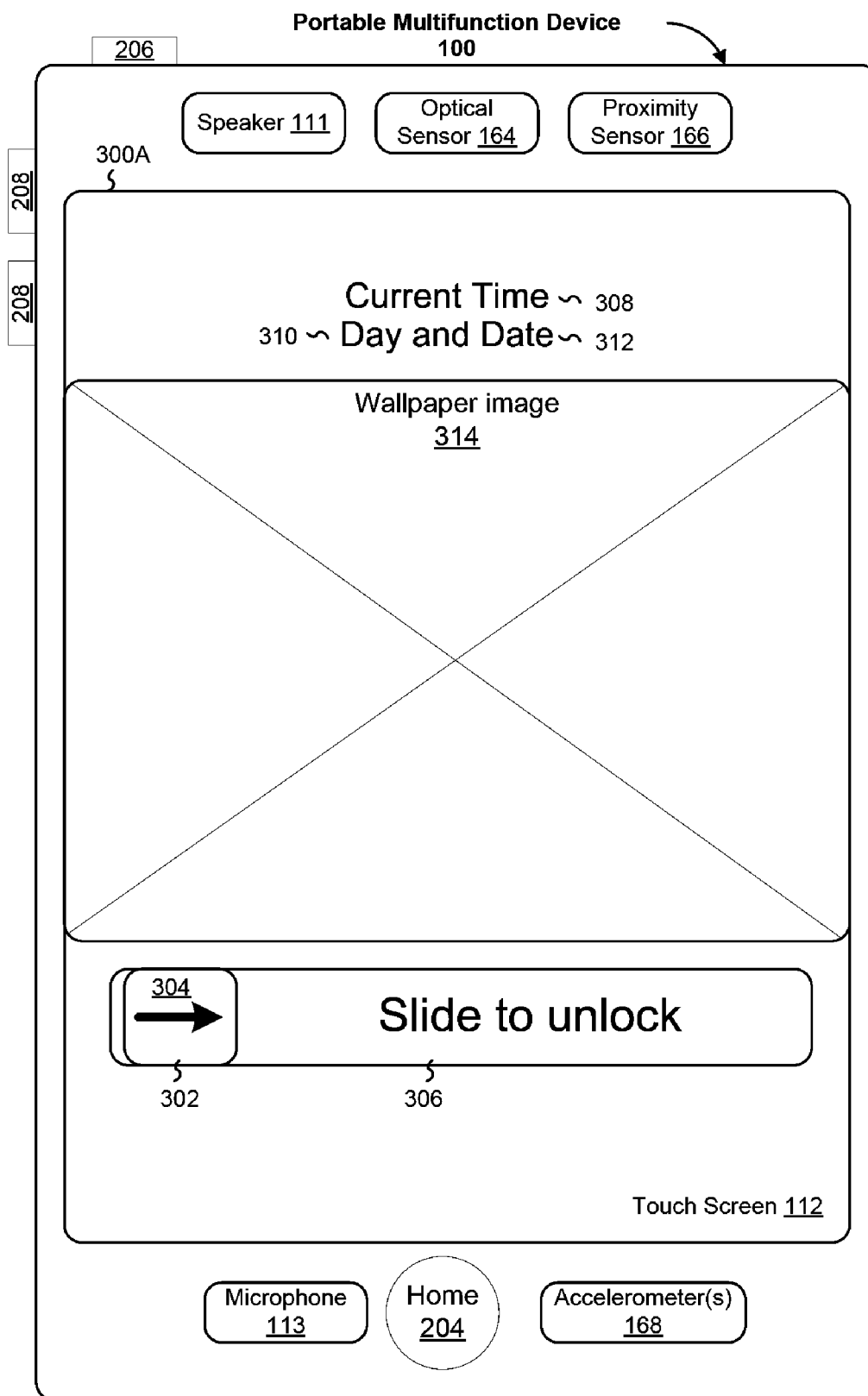


Figure 3A

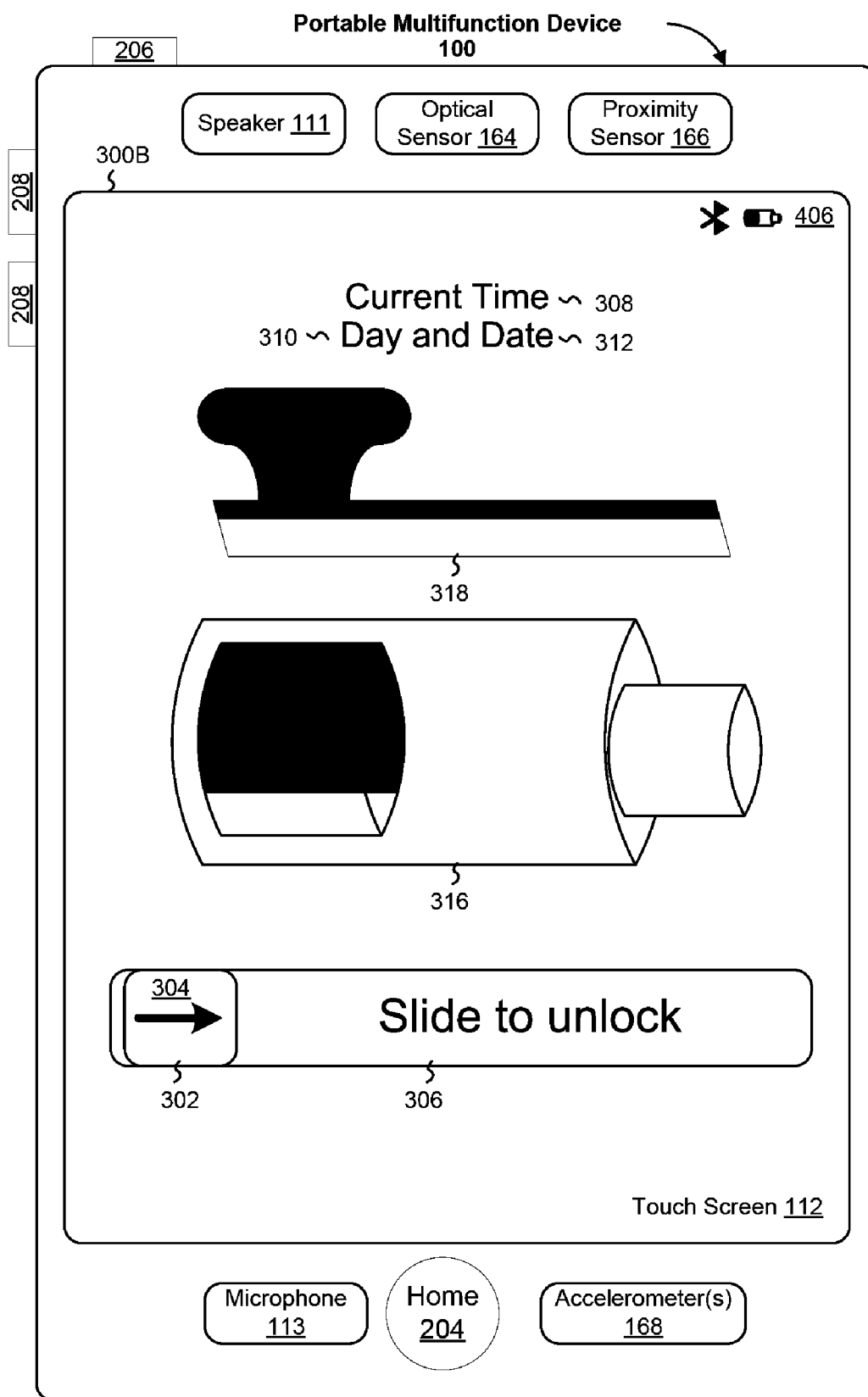


Figure 3B

U.S. Patent

Jan. 20, 2009

Sheet 6 of 293

US 7,479,949 B2

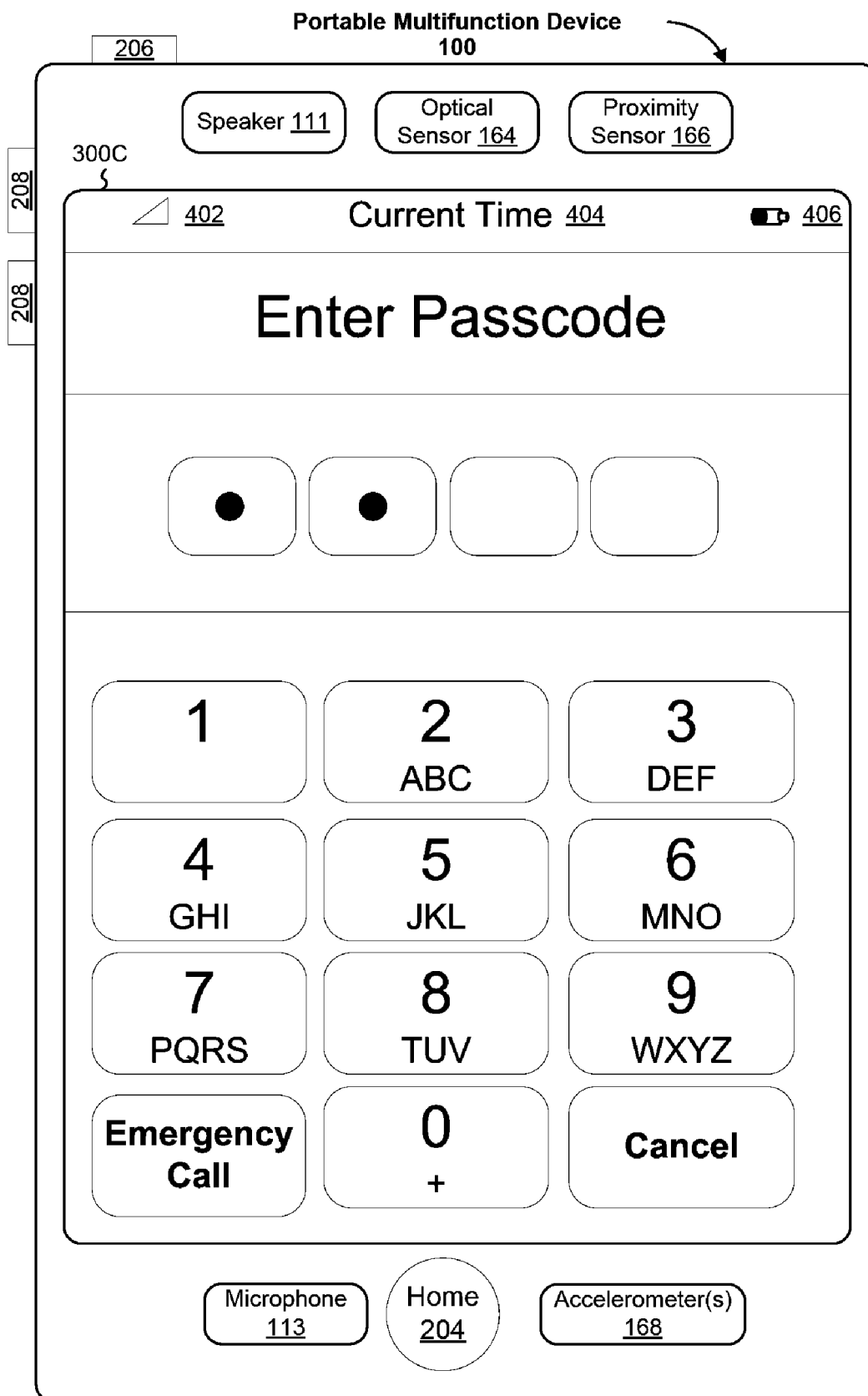


Figure 3C

U.S. Patent

Jan. 20, 2009

Sheet 7 of 293

US 7,479,949 B2

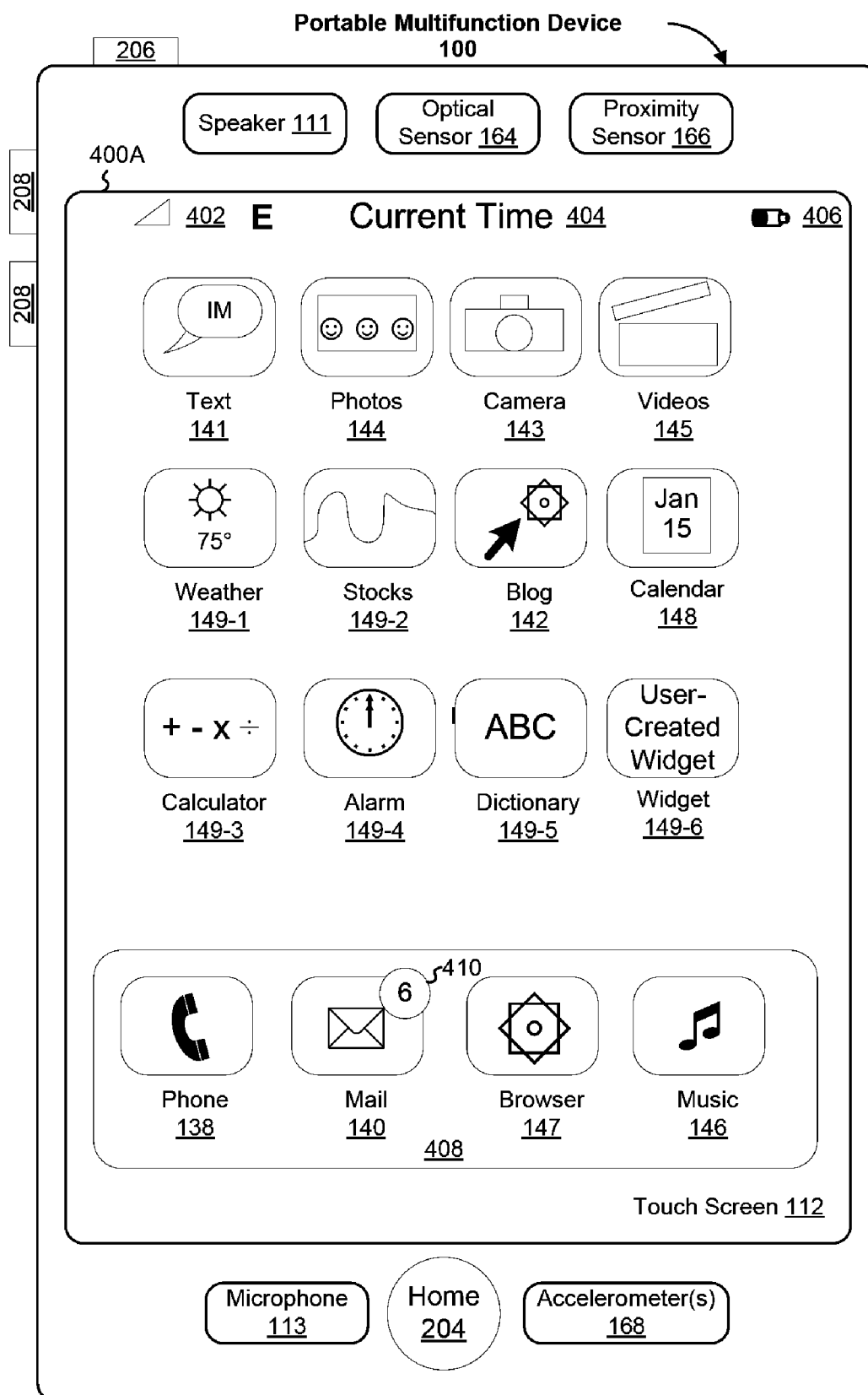


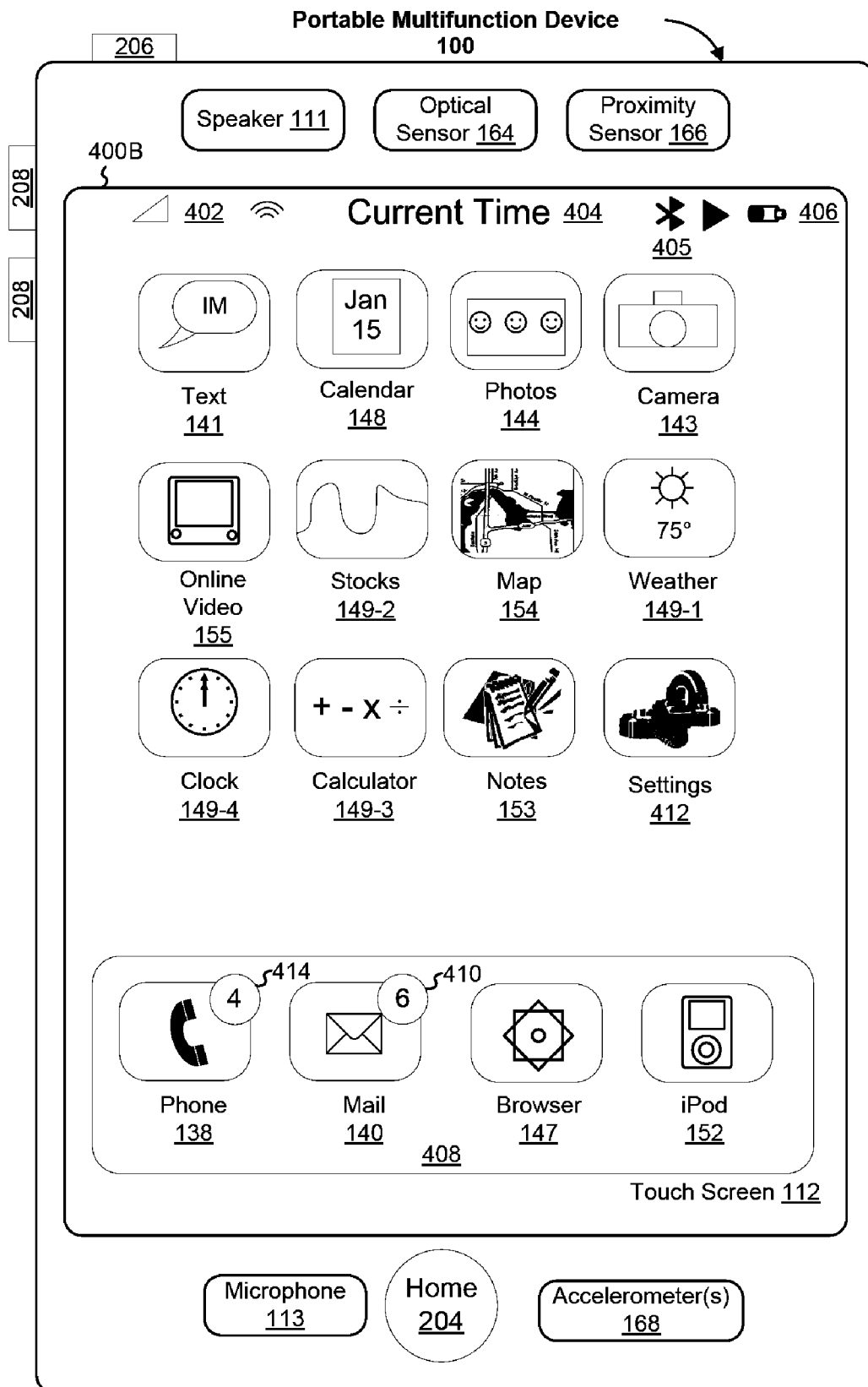
Figure 4A

U.S. Patent

Jan. 20, 2009

Sheet 8 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 9 of 293

US 7,479,949 B2

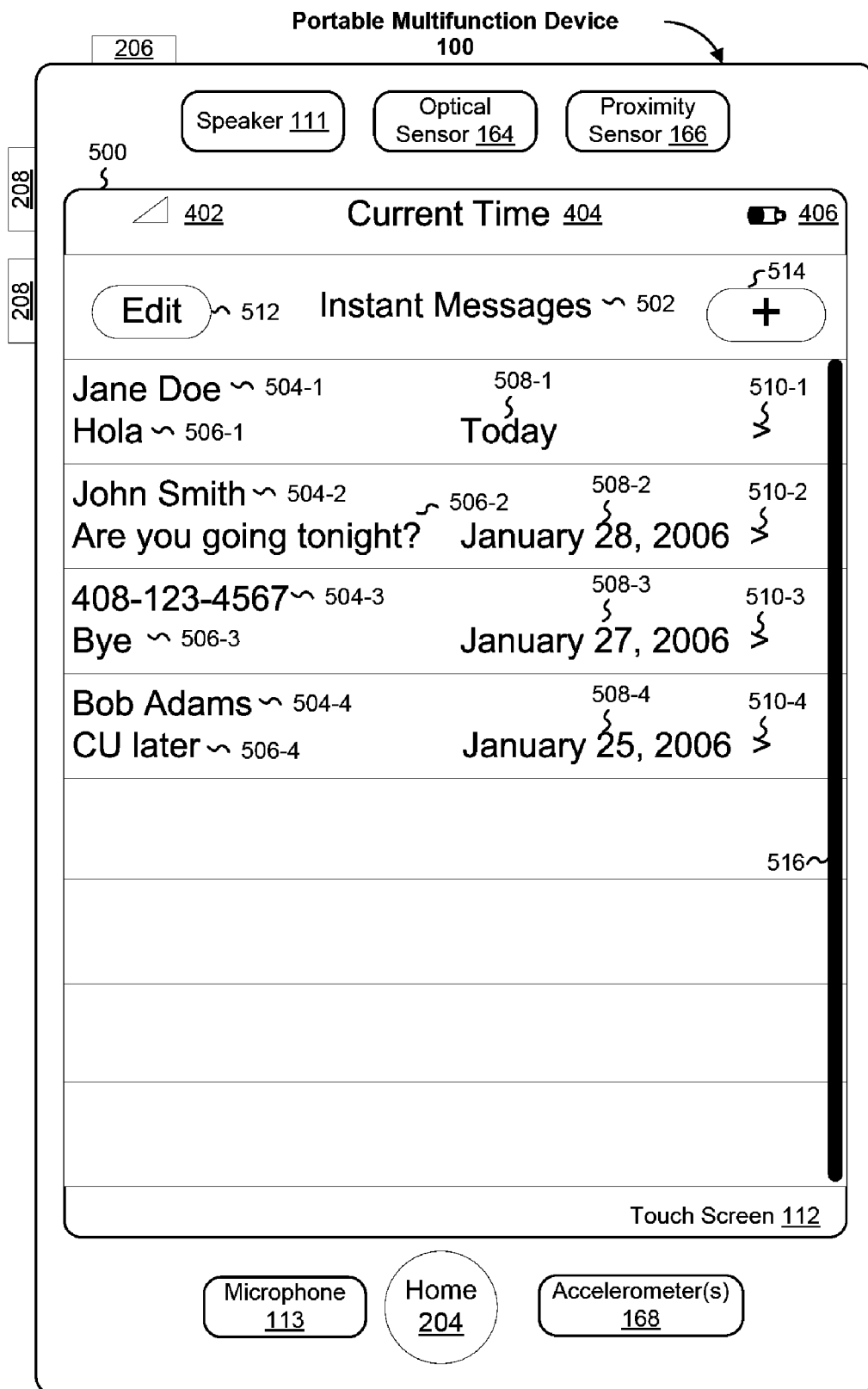


Figure 5

U.S. Patent

Jan. 20, 2009

Sheet 10 of 293

US 7,479,949 B2

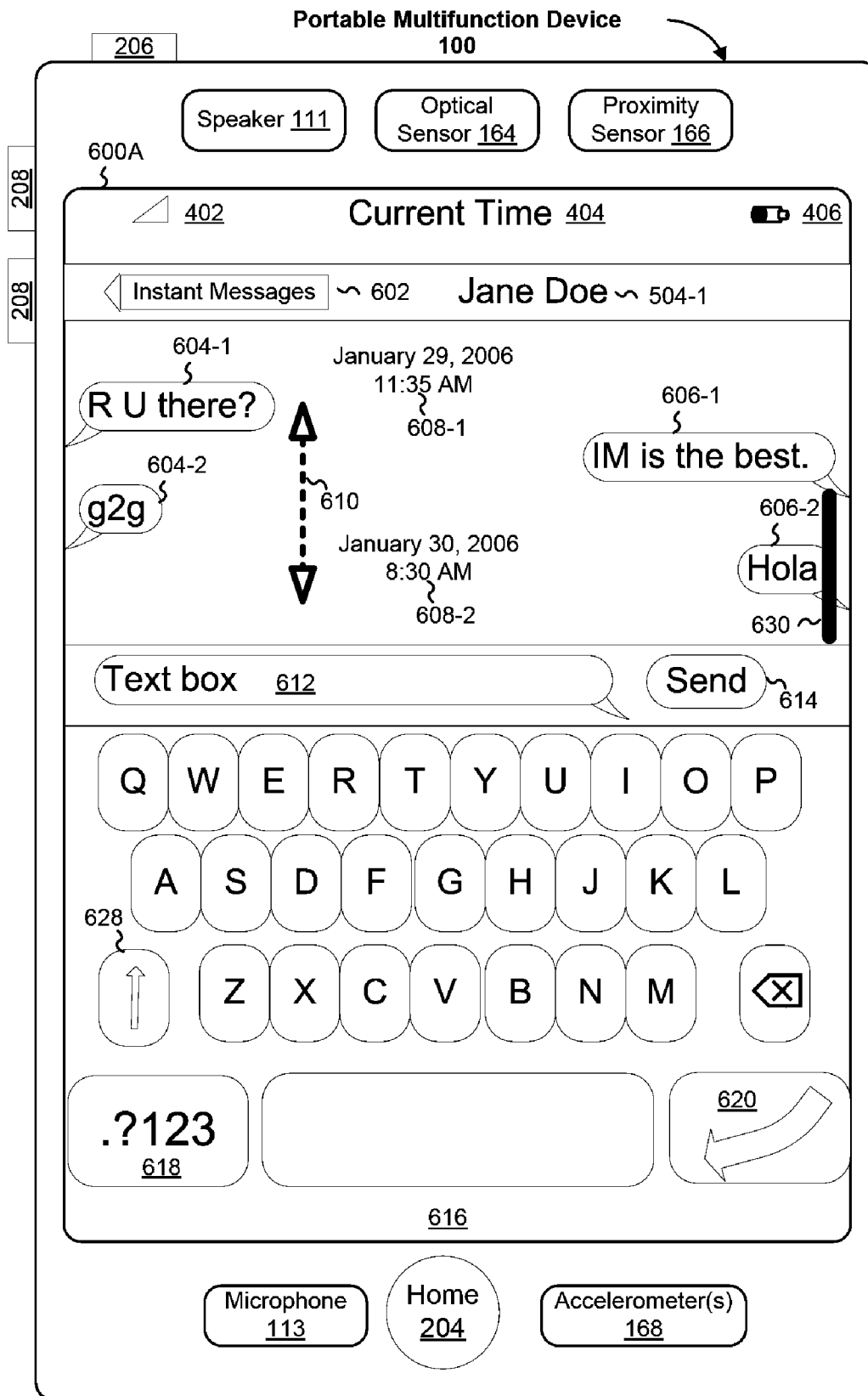


Figure 6A

U.S. Patent

Jan. 20, 2009

Sheet 11 of 293

US 7,479,949 B2

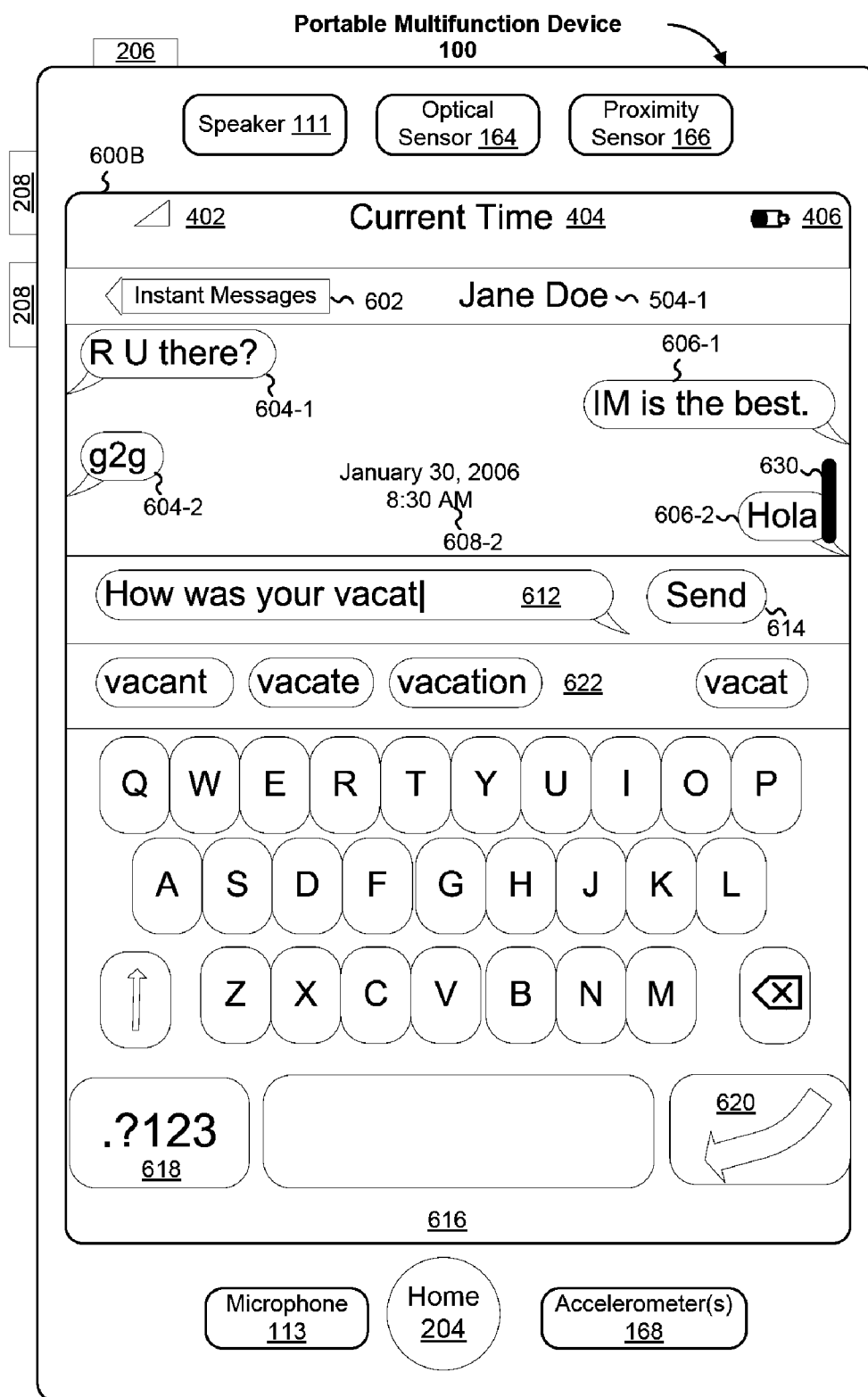


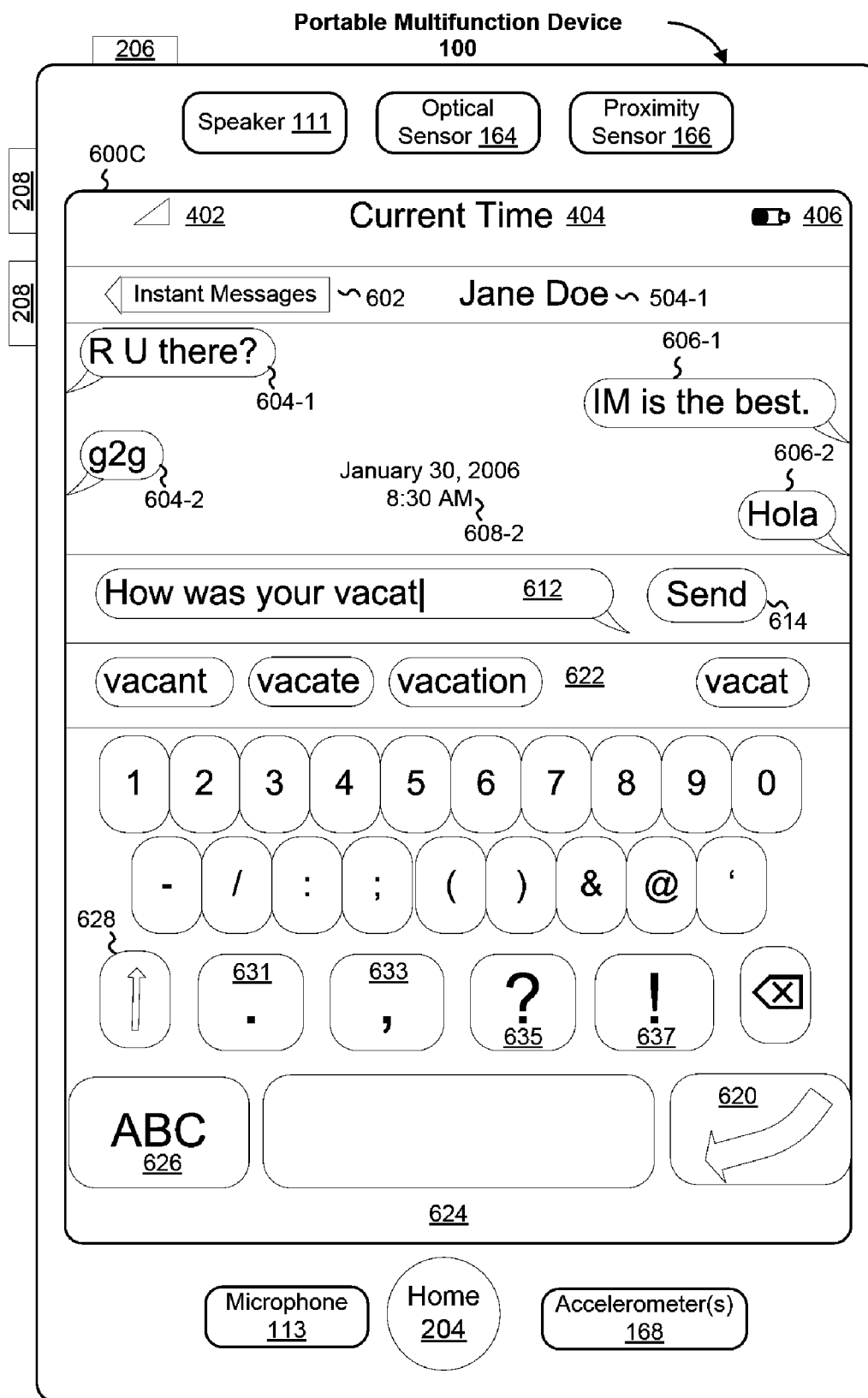
Figure 6B

U.S. Patent

Jan. 20, 2009

Sheet 12 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 13 of 293

US 7,479,949 B2

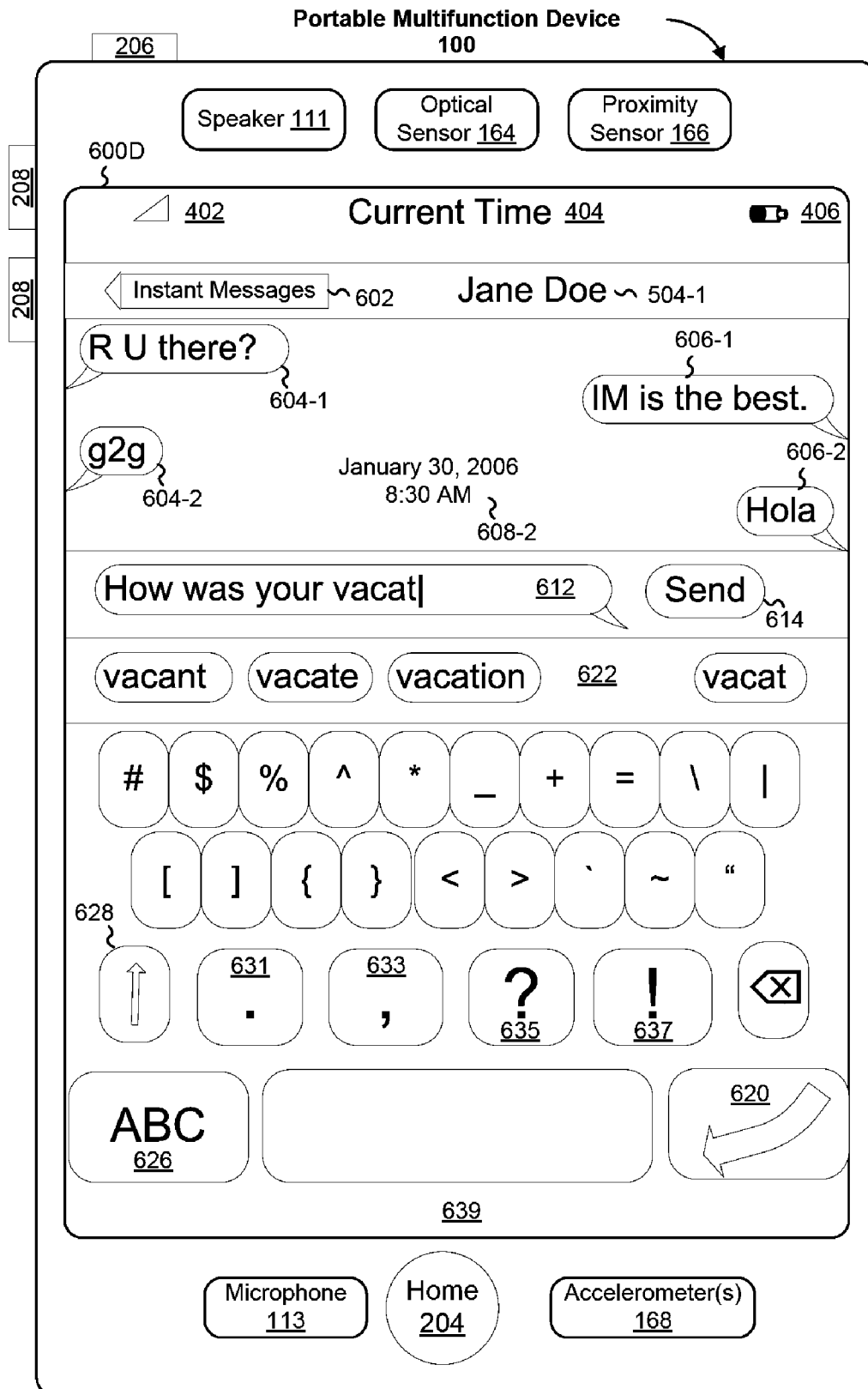


Figure 6D

U.S. Patent

Jan. 20, 2009

Sheet 14 of 293

US 7,479,949 B2

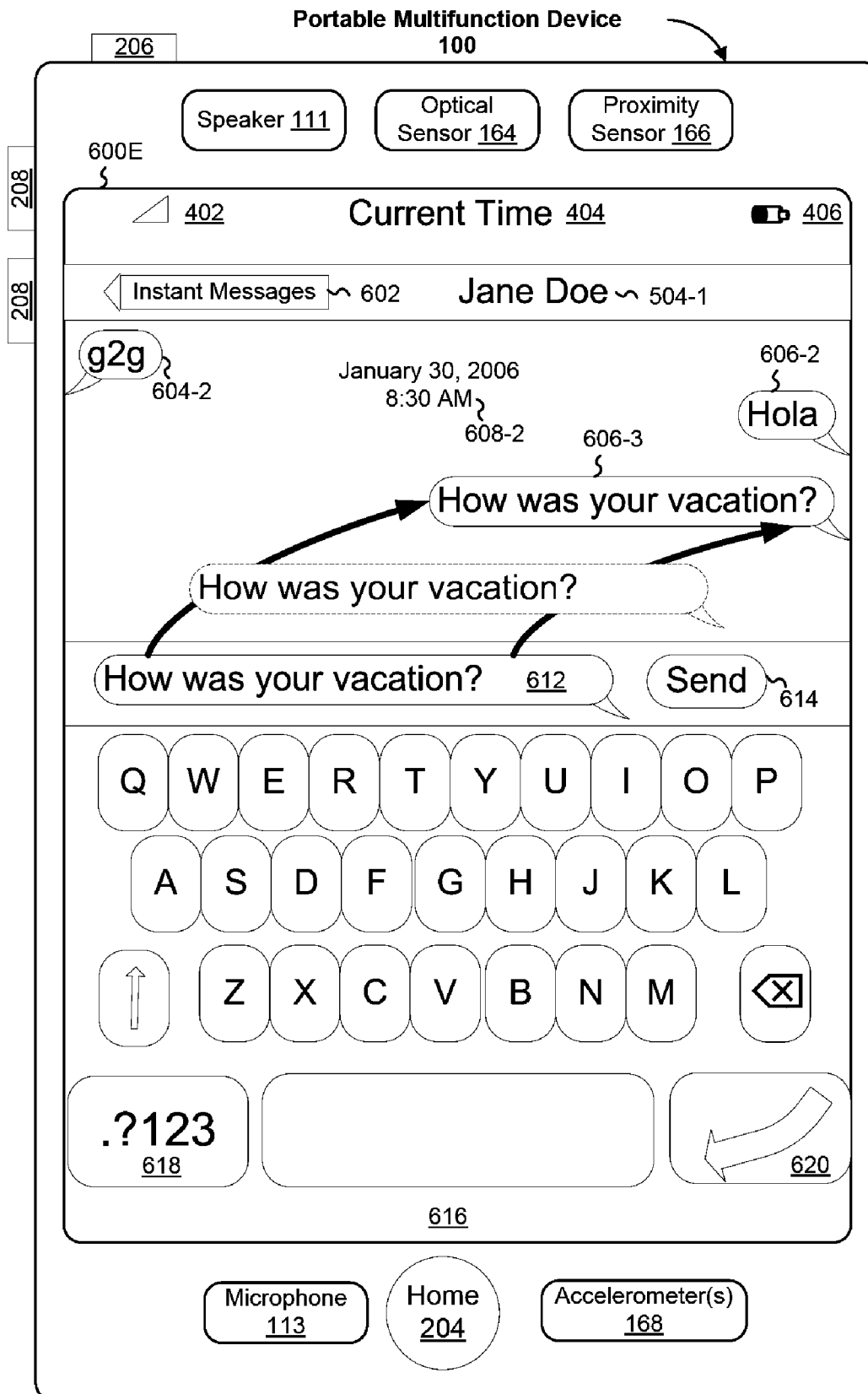


Figure 6E

U.S. Patent

Jan. 20, 2009

Sheet 15 of 293

US 7,479,949 B2



Figure 6F

U.S. Patent

Jan. 20, 2009

Sheet 16 of 293

US 7,479,949 B2

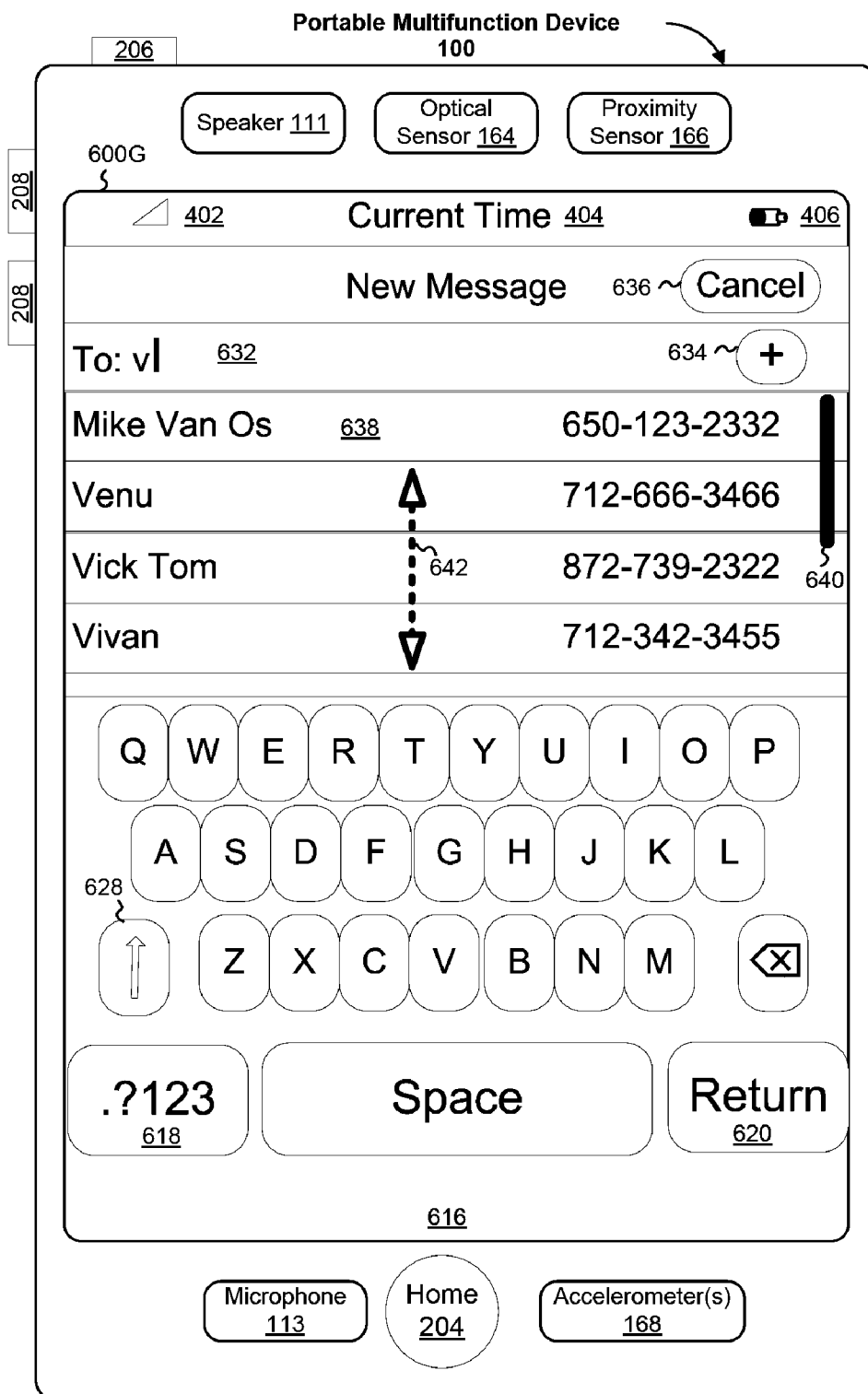


Figure 6G

U.S. Patent

Jan. 20, 2009

Sheet 17 of 293

US 7,479,949 B2



Figure 6H

U.S. Patent

Jan. 20, 2009

Sheet 18 of 293

US 7,479,949 B2

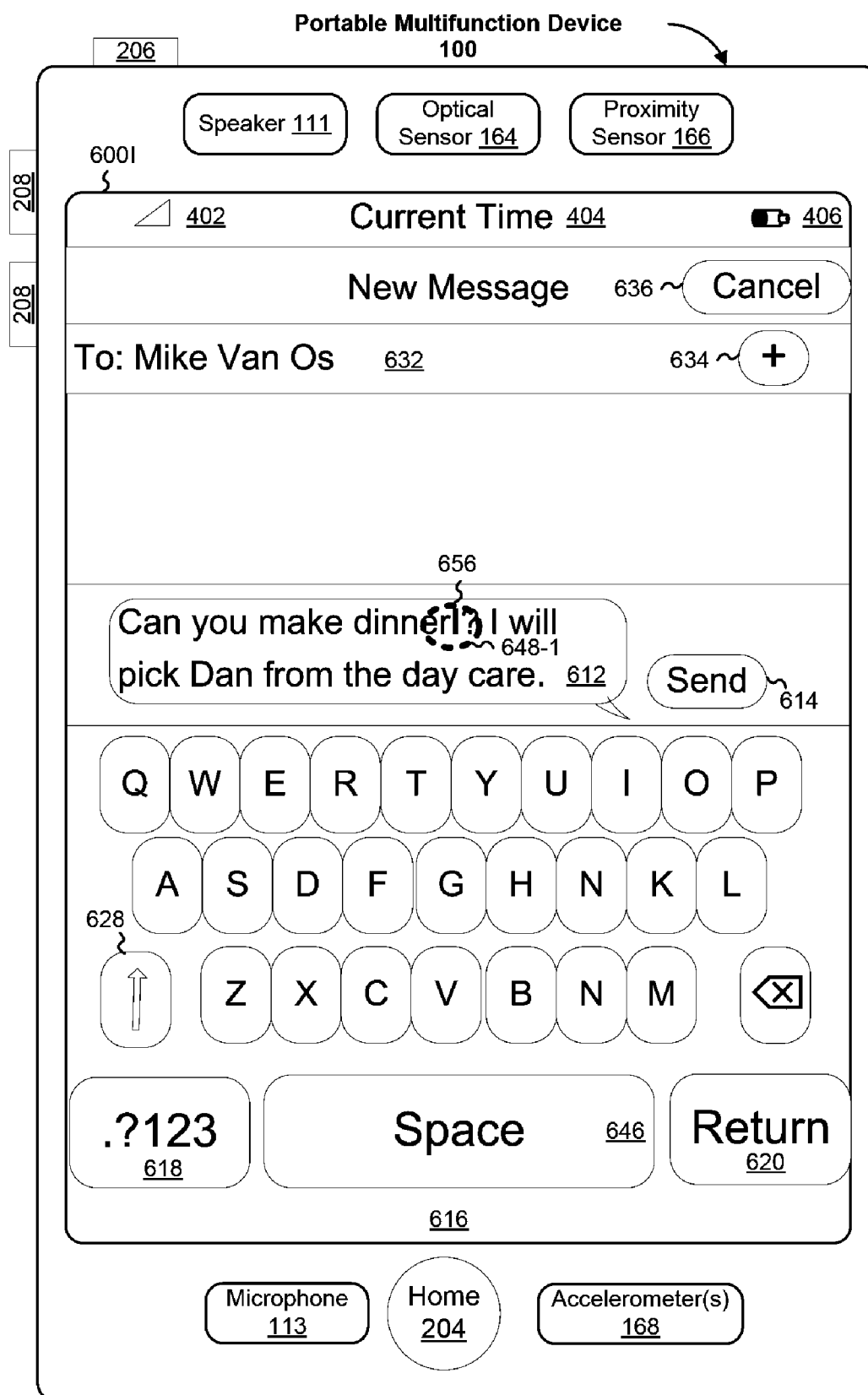


Figure 61

U.S. Patent

Jan. 20, 2009

Sheet 19 of 293

US 7,479,949 B2



Figure 6J

U.S. Patent

Jan. 20, 2009

Sheet 20 of 293

US 7,479,949 B2

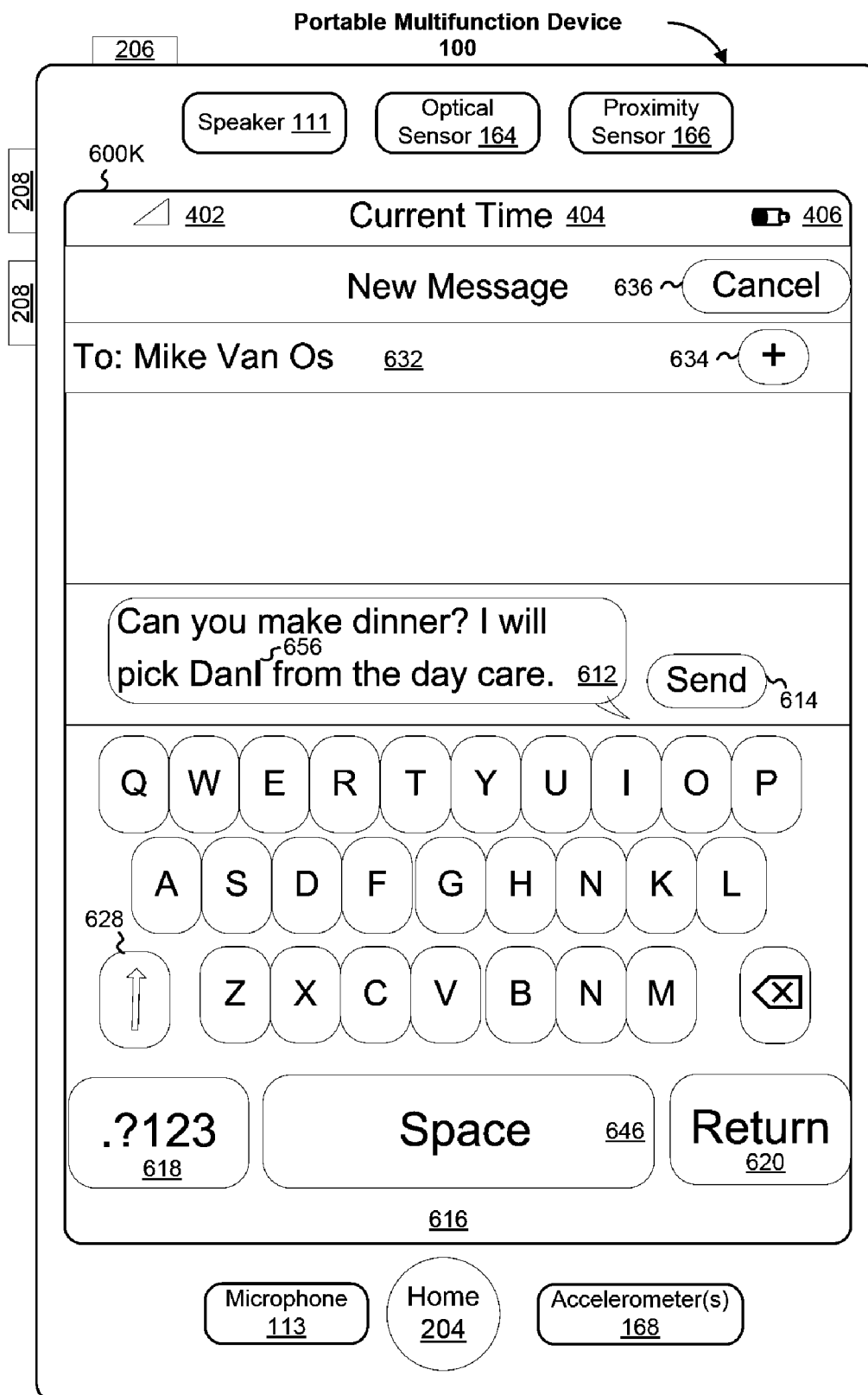


Figure 6K

U.S. Patent

Jan. 20, 2009

Sheet 21 of 293

US 7,479,949 B2

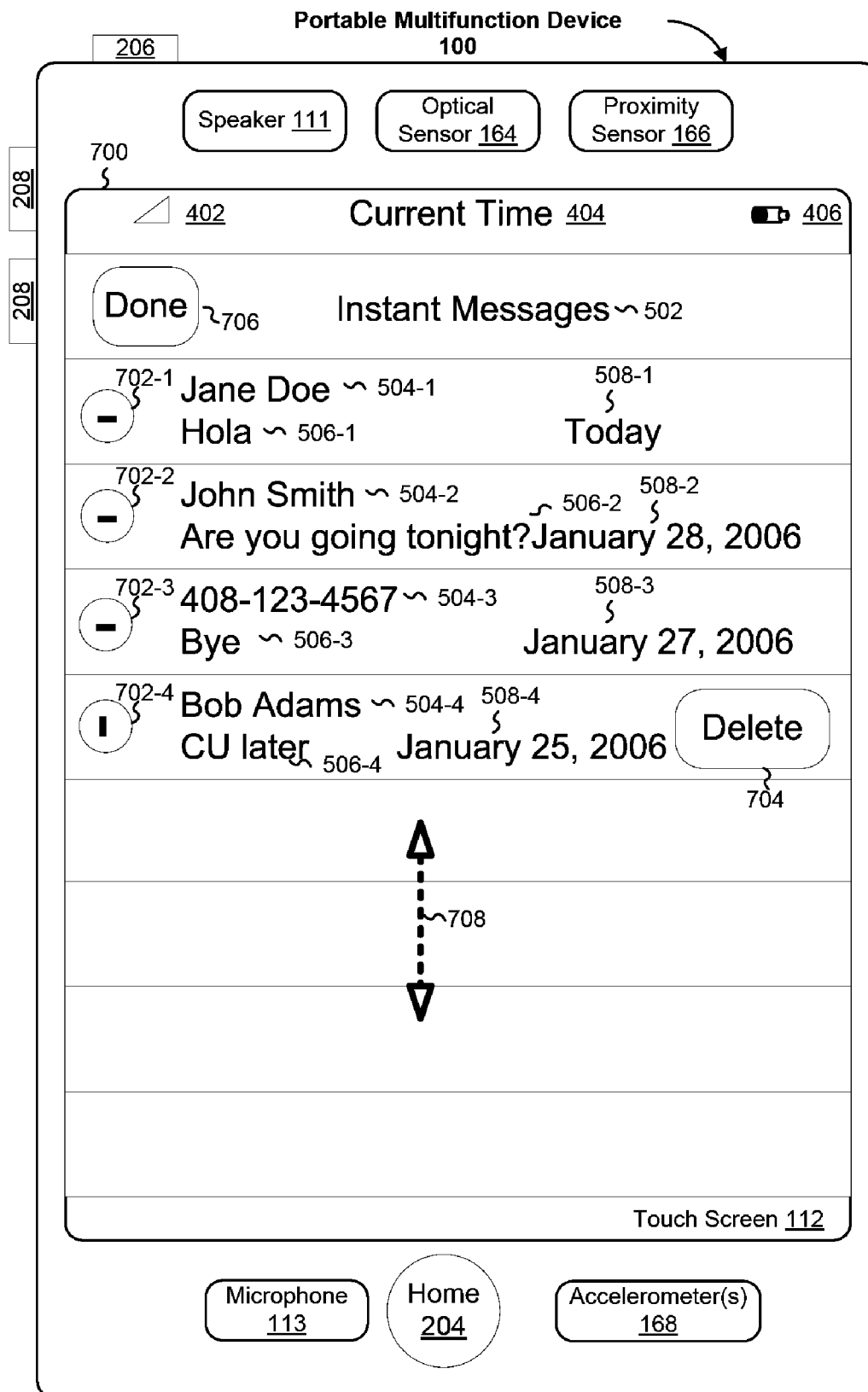


Figure 7

U.S. Patent

Jan. 20, 2009

Sheet 22 of 293

US 7,479,949 B2

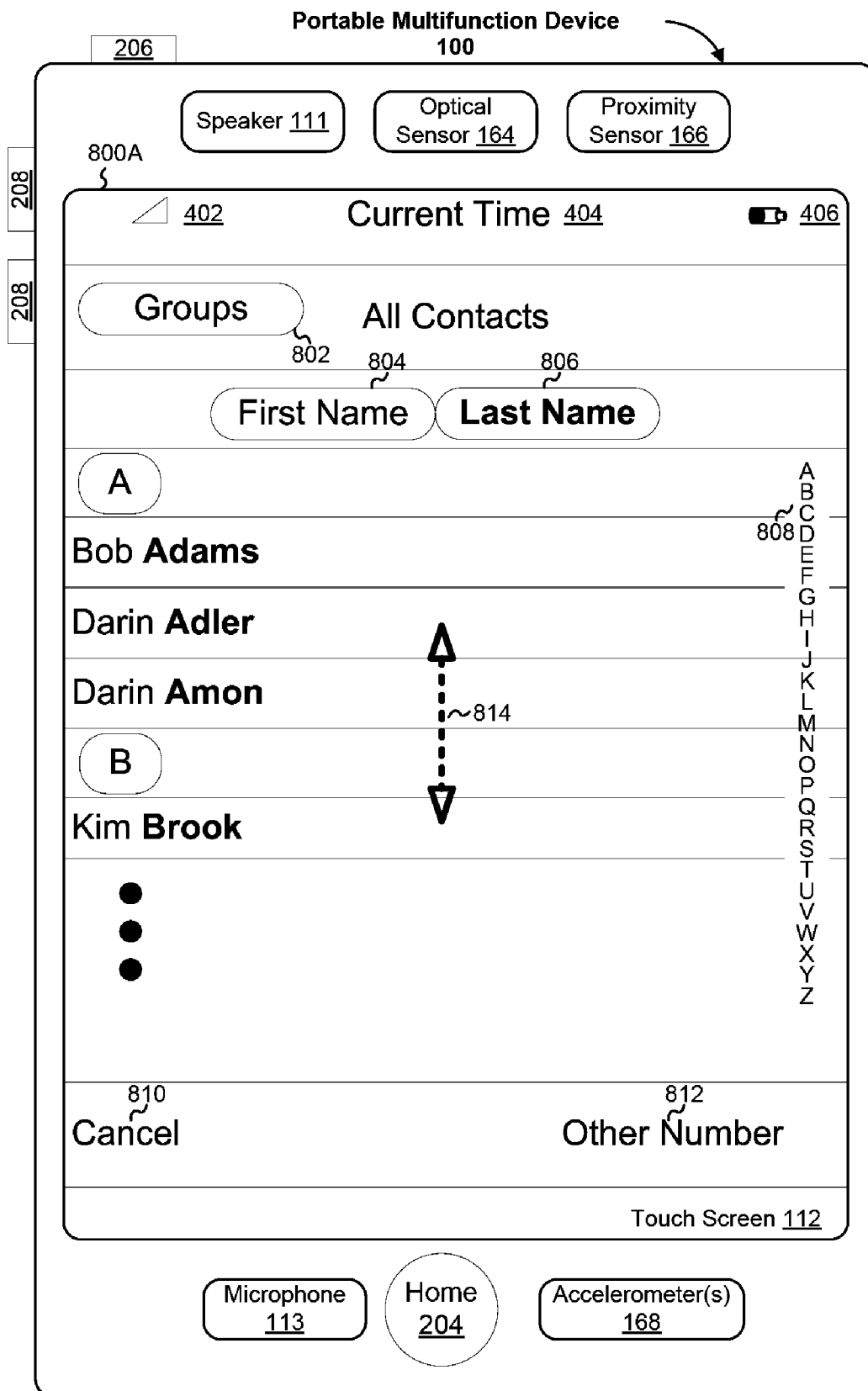


Figure 8A

U.S. Patent

Jan. 20, 2009

Sheet 23 of 293

US 7,479,949 B2

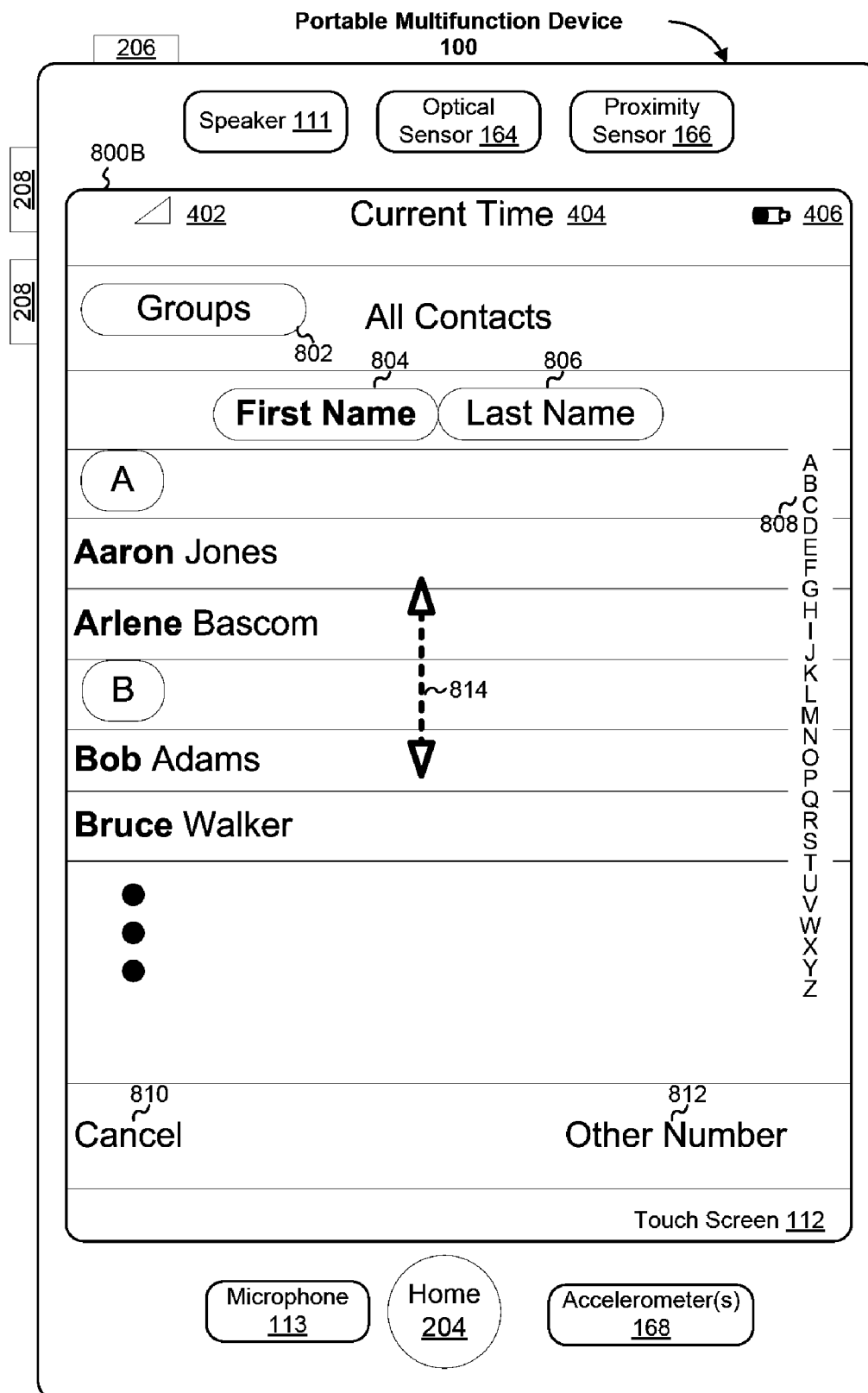


Figure 8B

U.S. Patent

Jan. 20, 2009

Sheet 24 of 293

US 7,479,949 B2

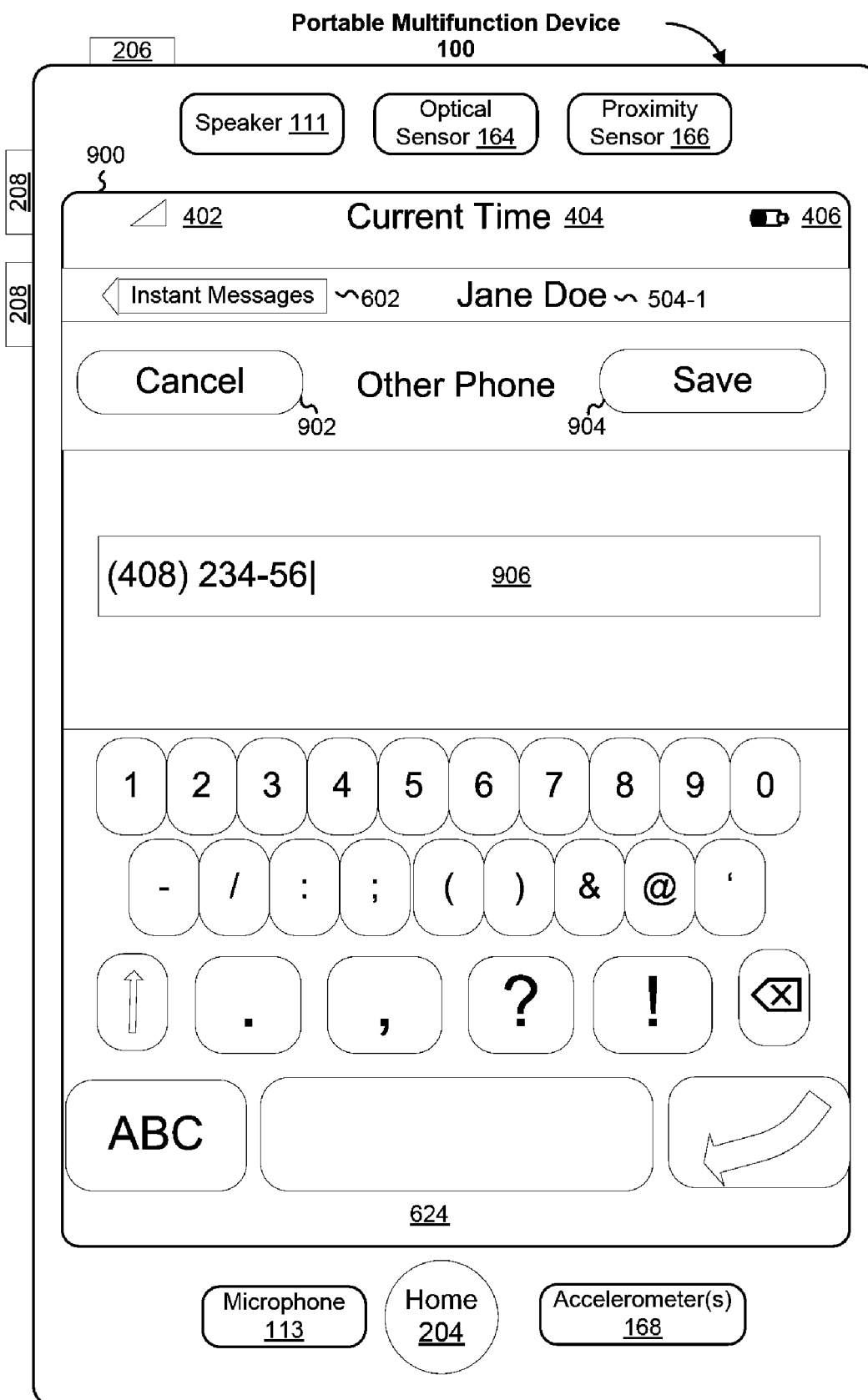


Figure 9

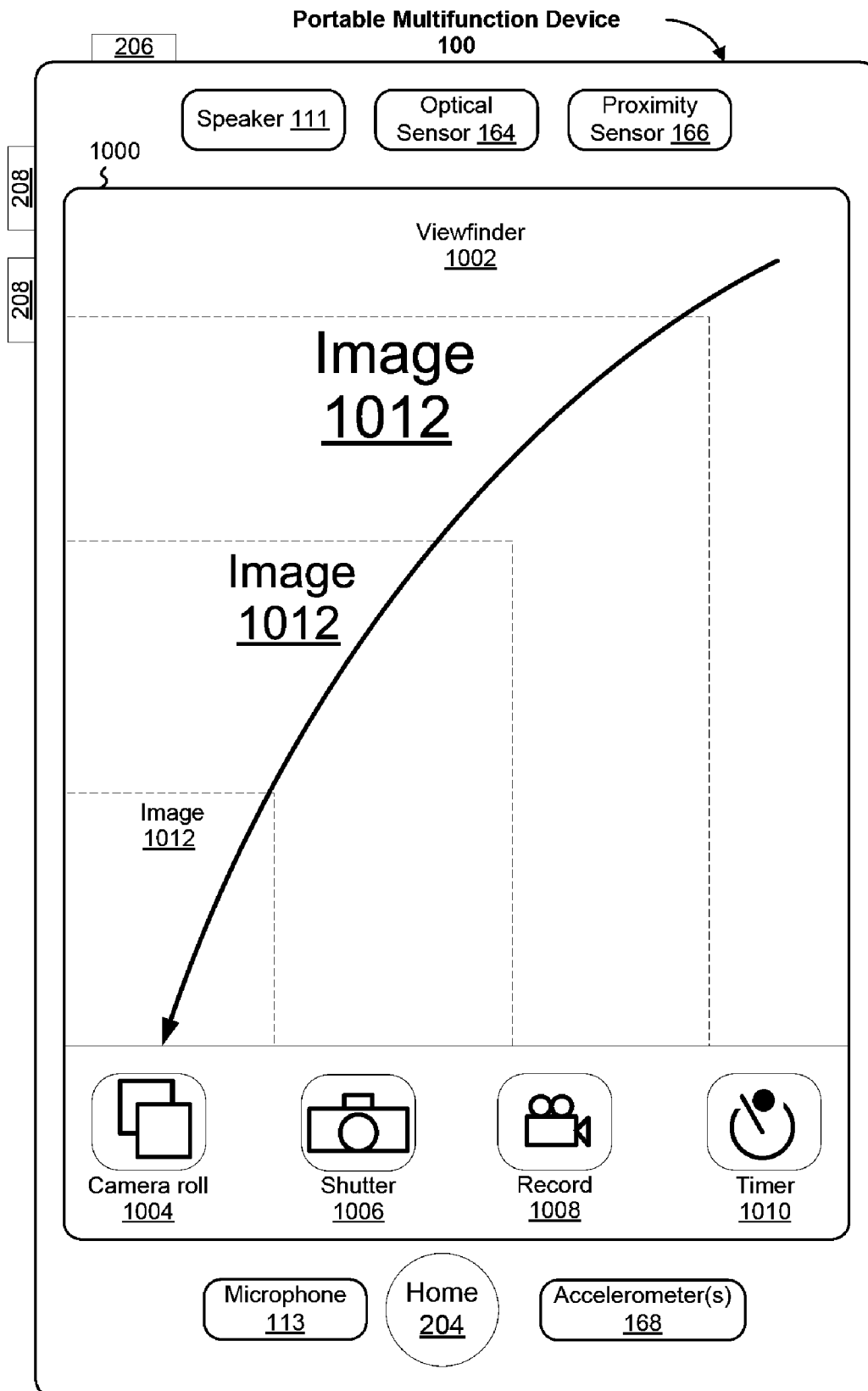


Figure 10

U.S. Patent

Jan. 20, 2009

Sheet 26 of 293

US 7,479,949 B2

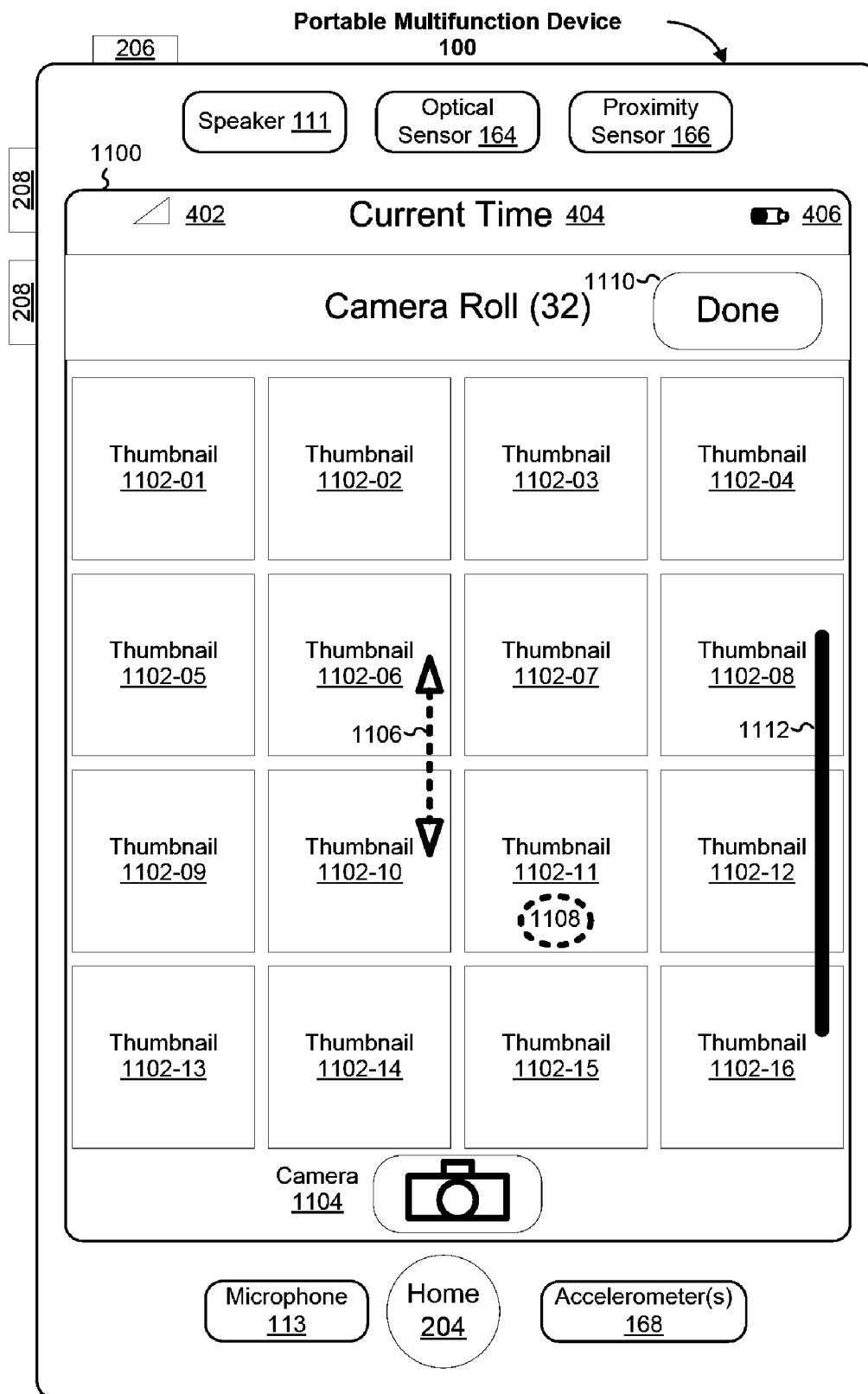


Figure 11

U.S. Patent

Jan. 20, 2009

Sheet 27 of 293

US 7,479,949 B2

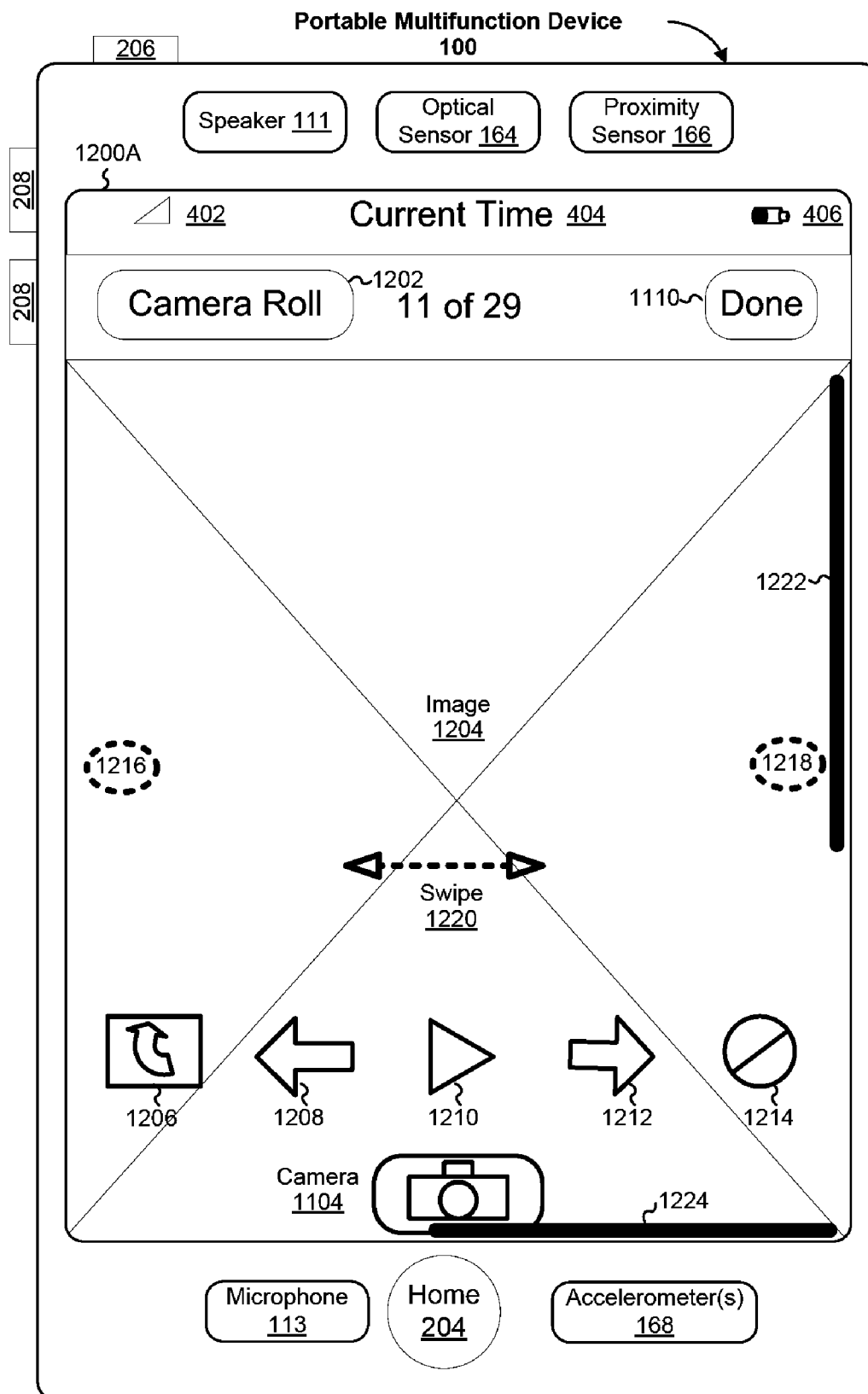


Figure 12A

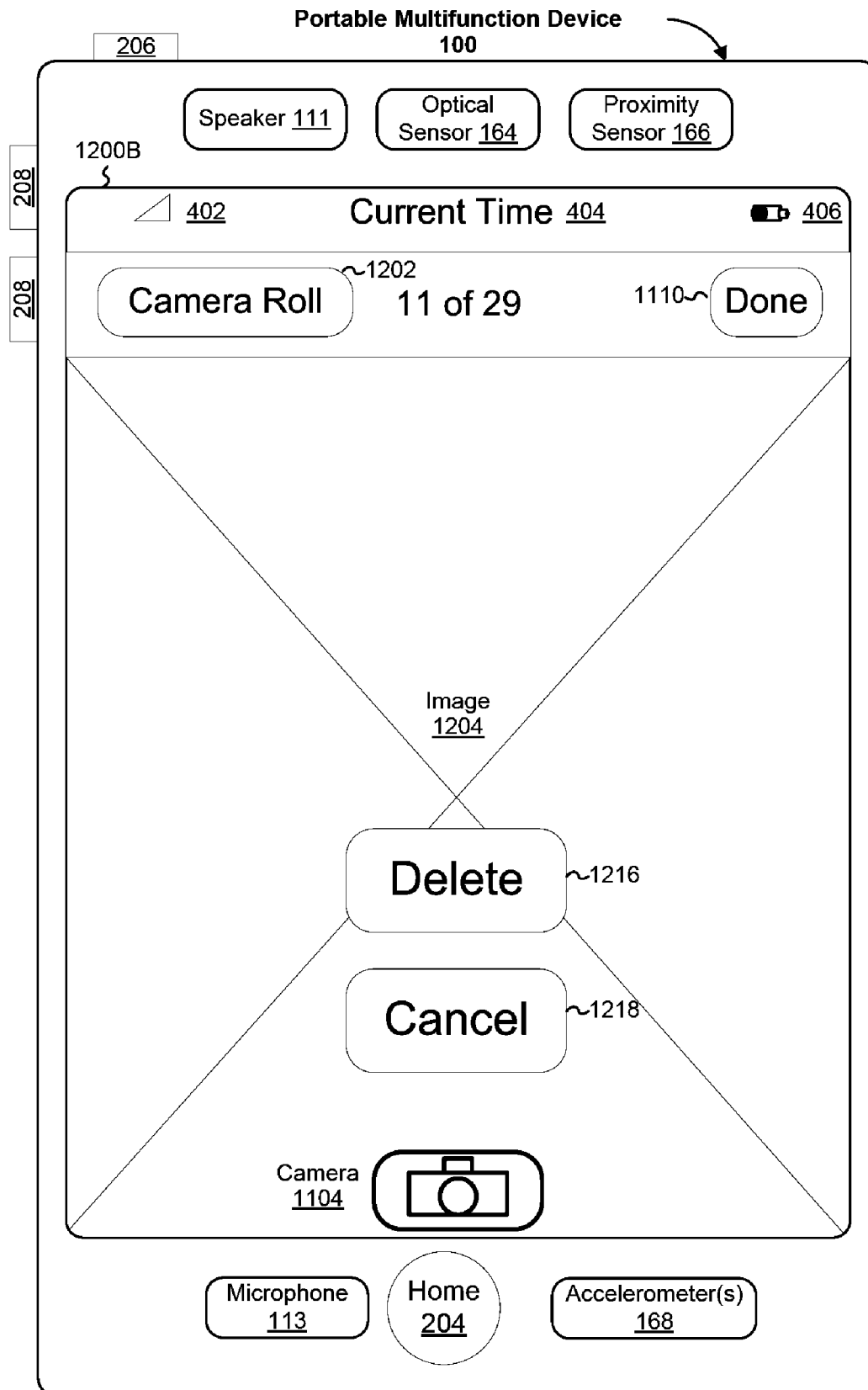


Figure 12B

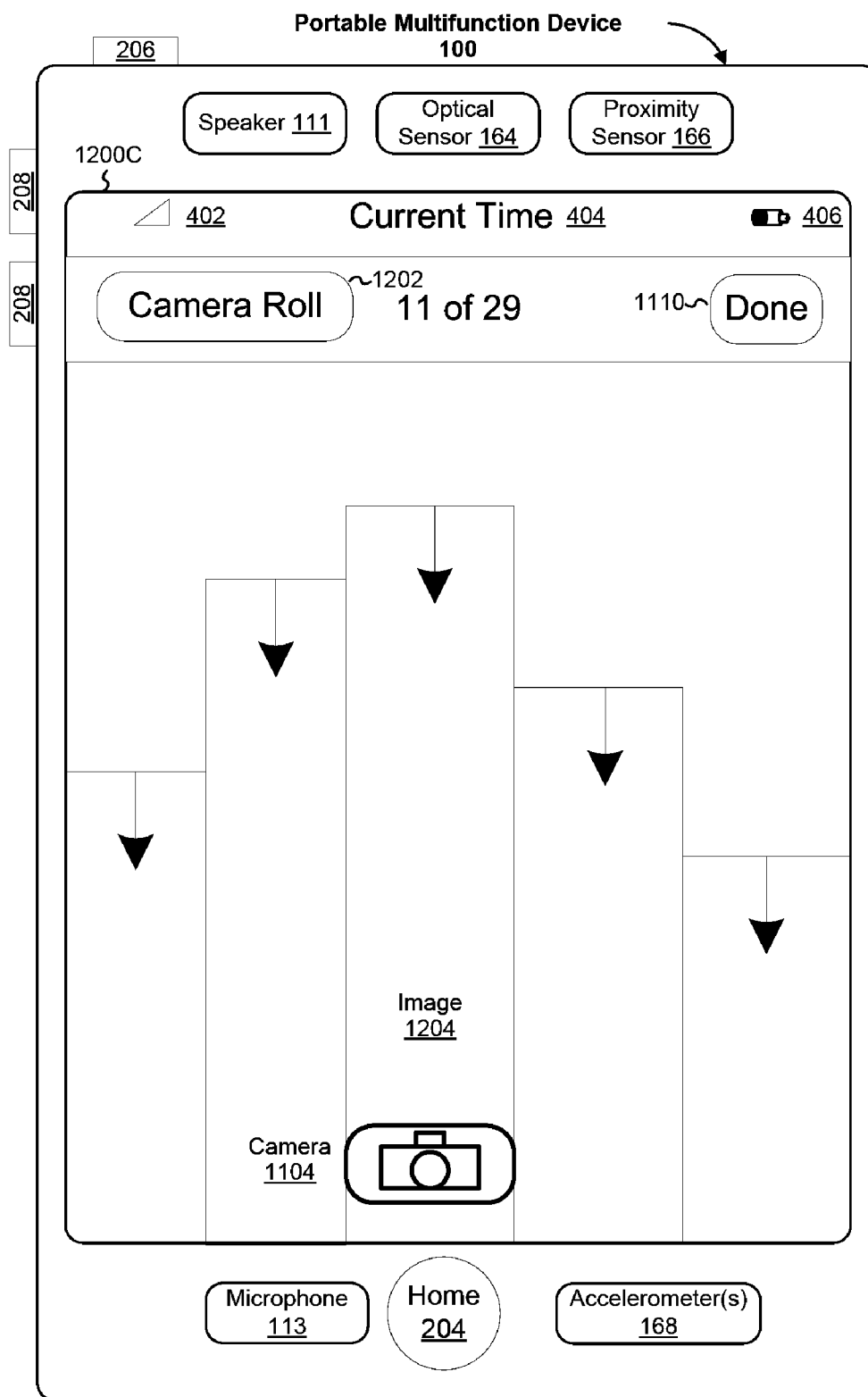


Figure 12C

U.S. Patent

Jan. 20, 2009

Sheet 30 of 293

US 7,479,949 B2

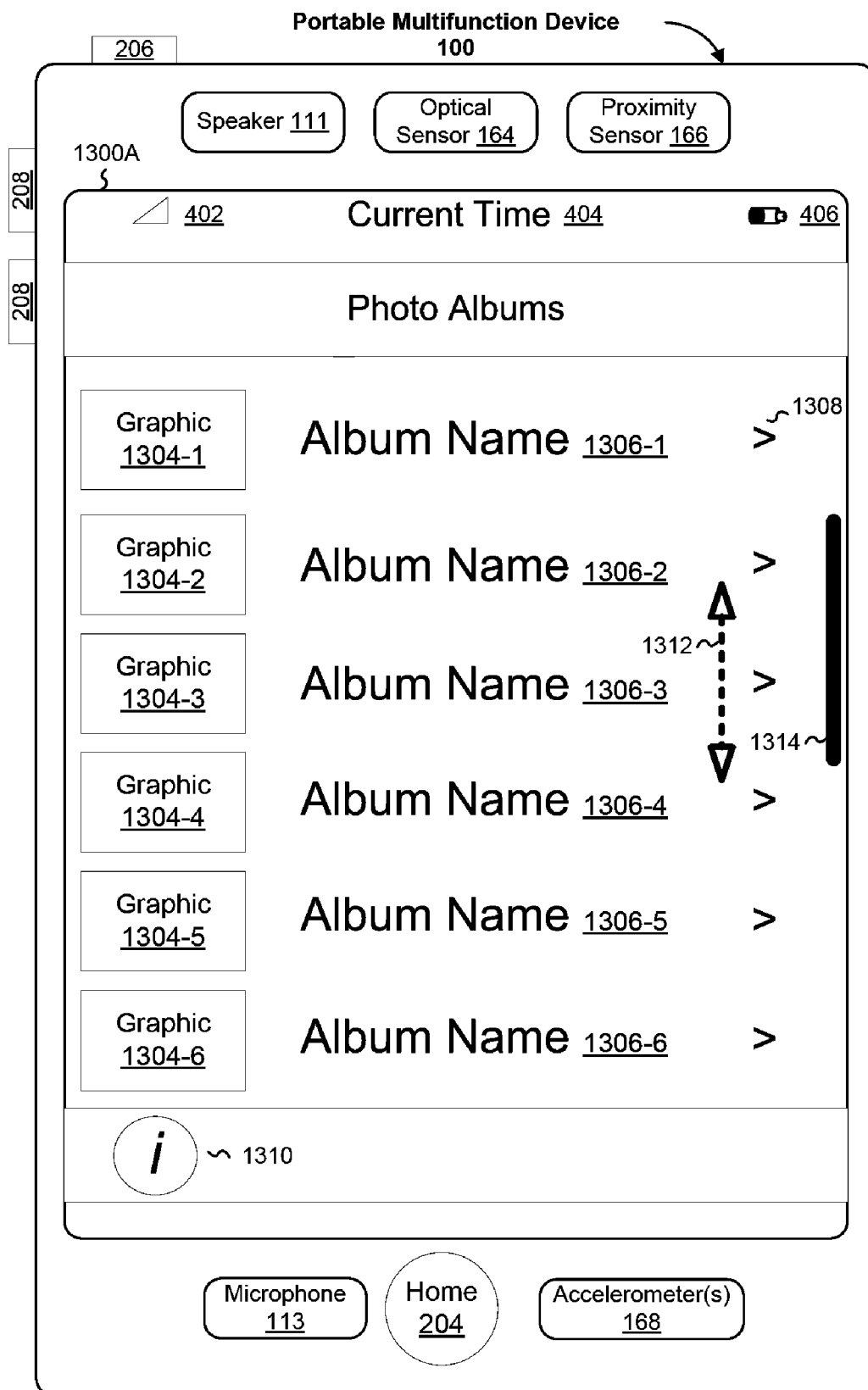


Figure 13A

U.S. Patent

Jan. 20, 2009

Sheet 31 of 293

US 7,479,949 B2

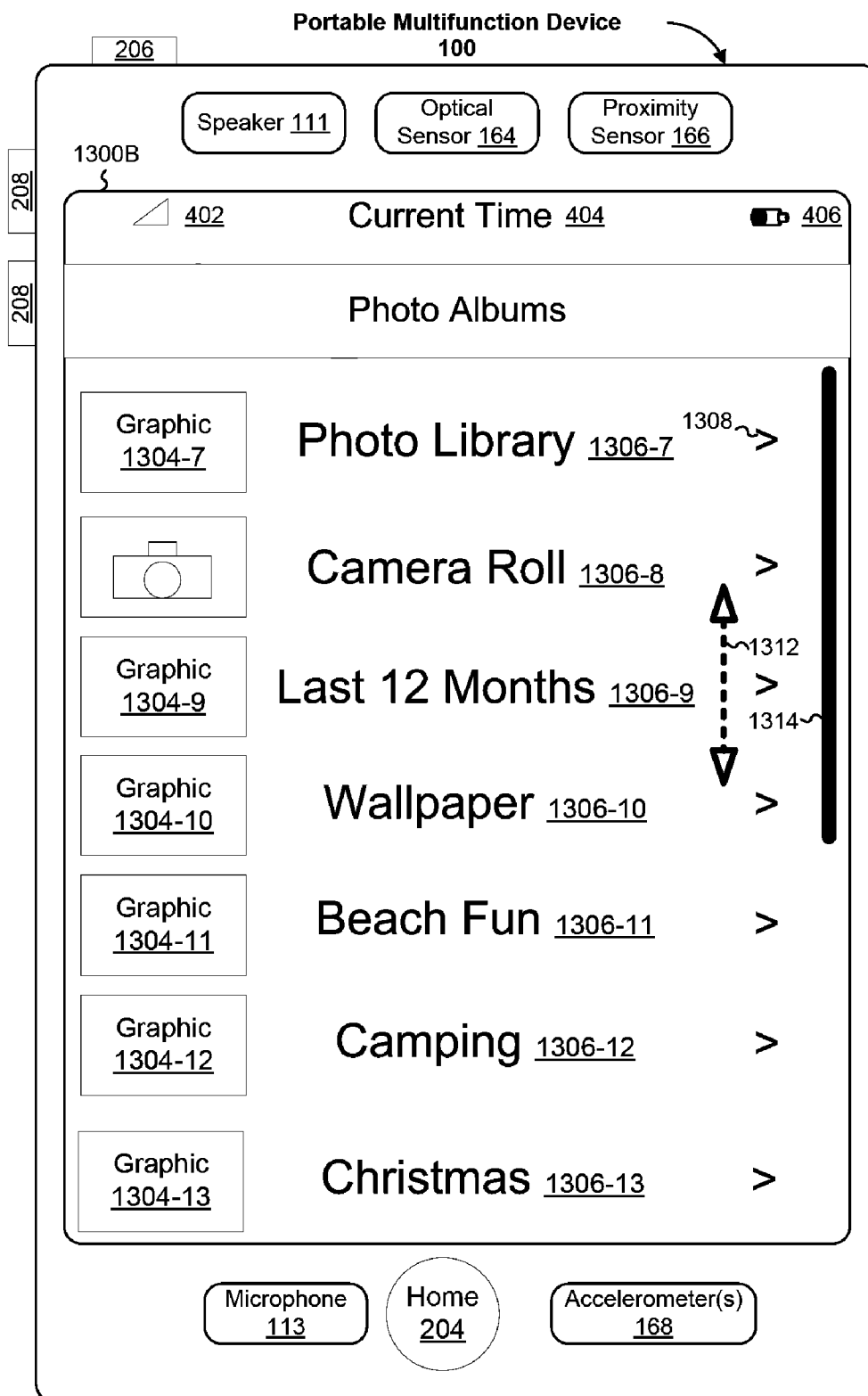


Figure 13B

U.S. Patent

Jan. 20, 2009

Sheet 32 of 293

US 7,479,949 B2

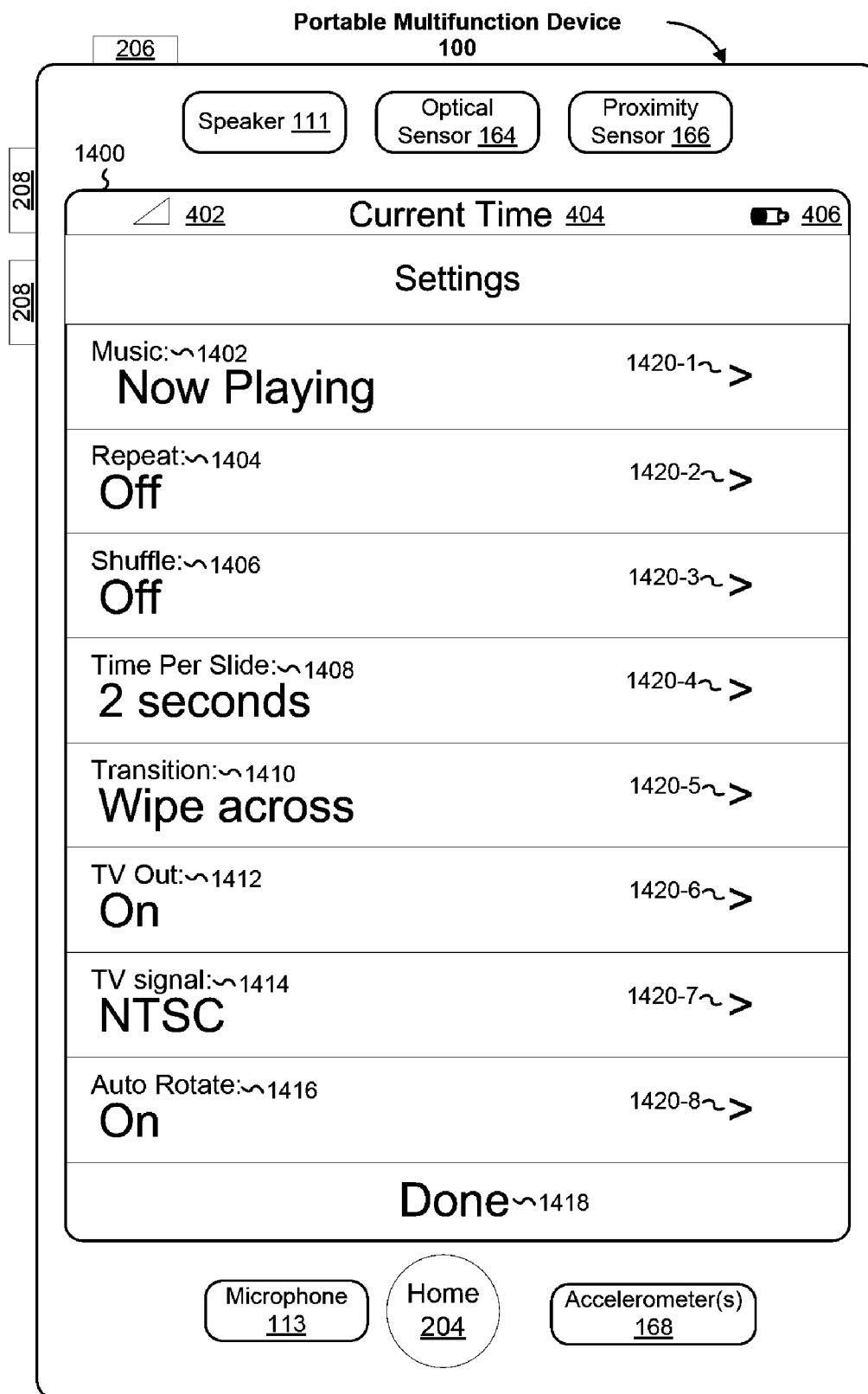


Figure 14

U.S. Patent

Jan. 20, 2009

Sheet 33 of 293

US 7,479,949 B2

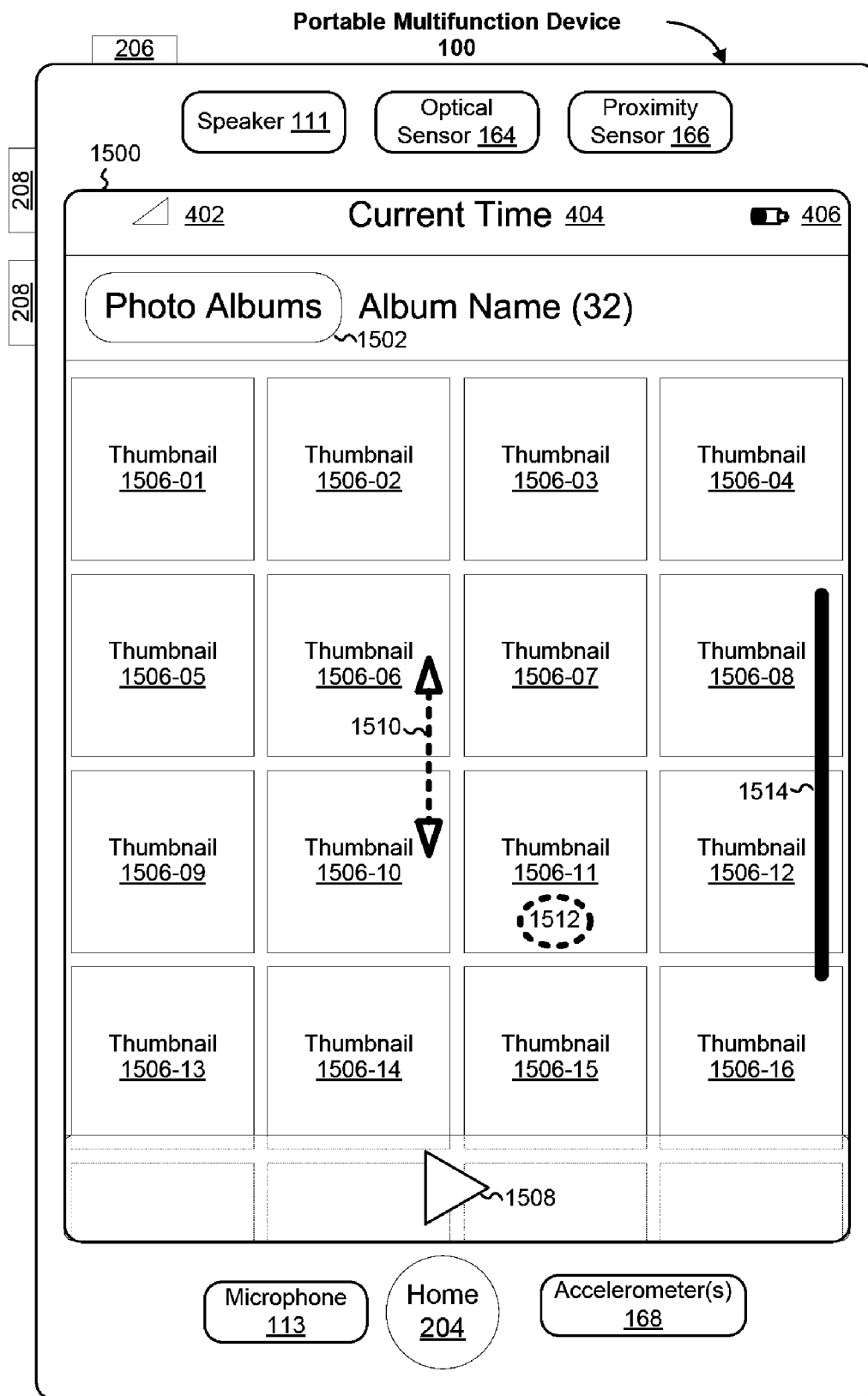


Figure 15

U.S. Patent

Jan. 20, 2009

Sheet 34 of 293

US 7,479,949 B2

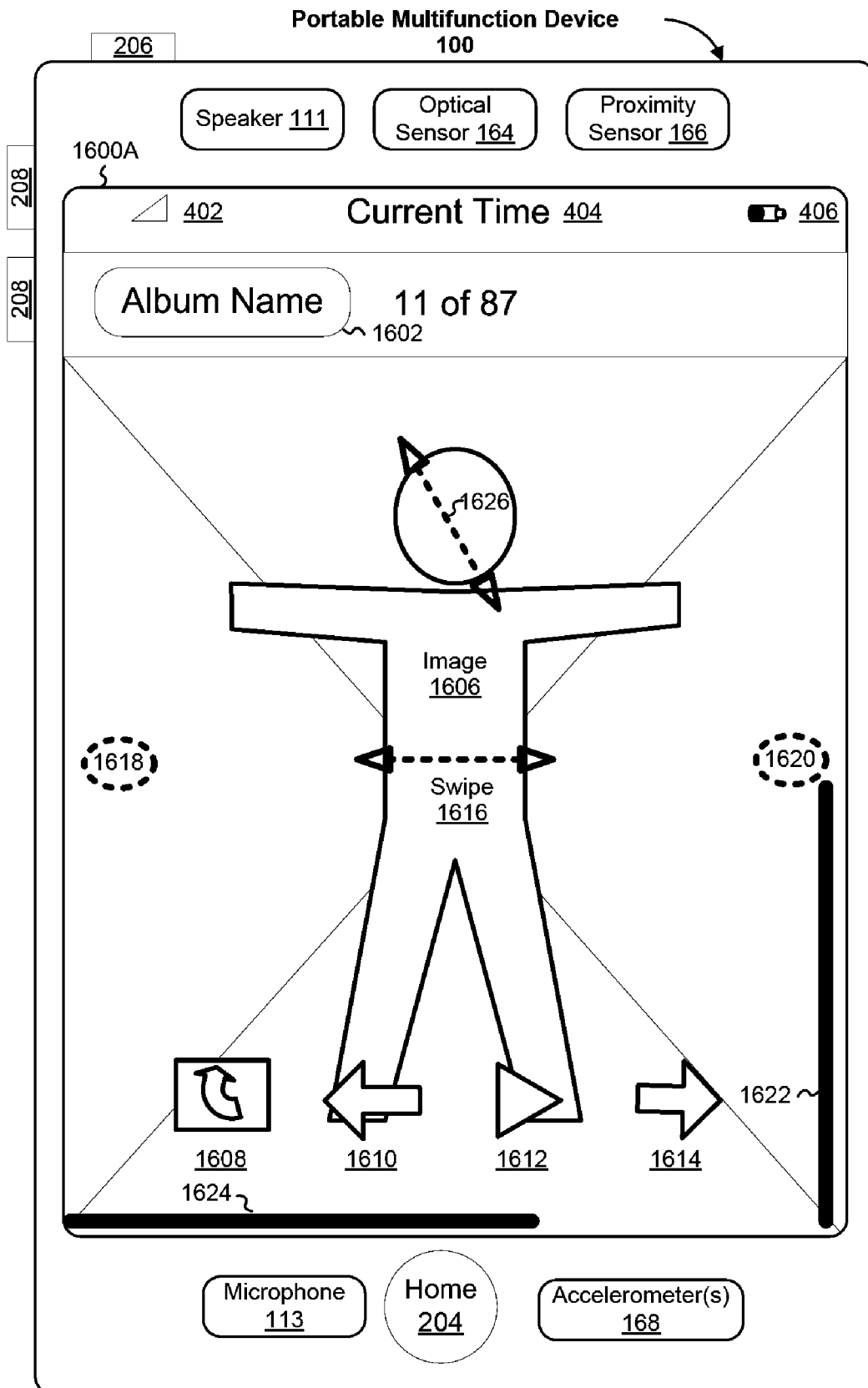
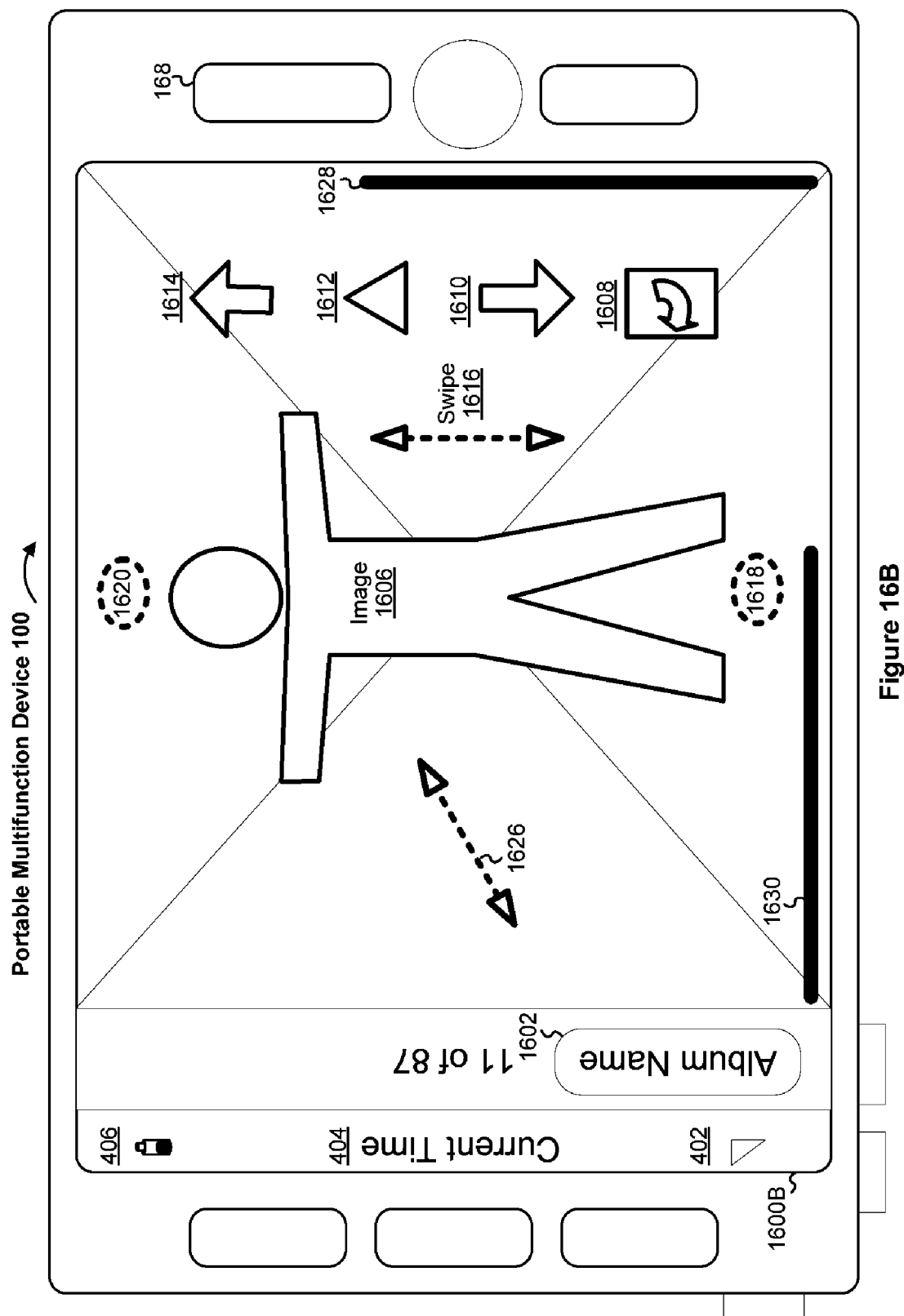


Figure 16A



U.S. Patent

Jan. 20, 2009

Sheet 36 of 293

US 7,479,949 B2

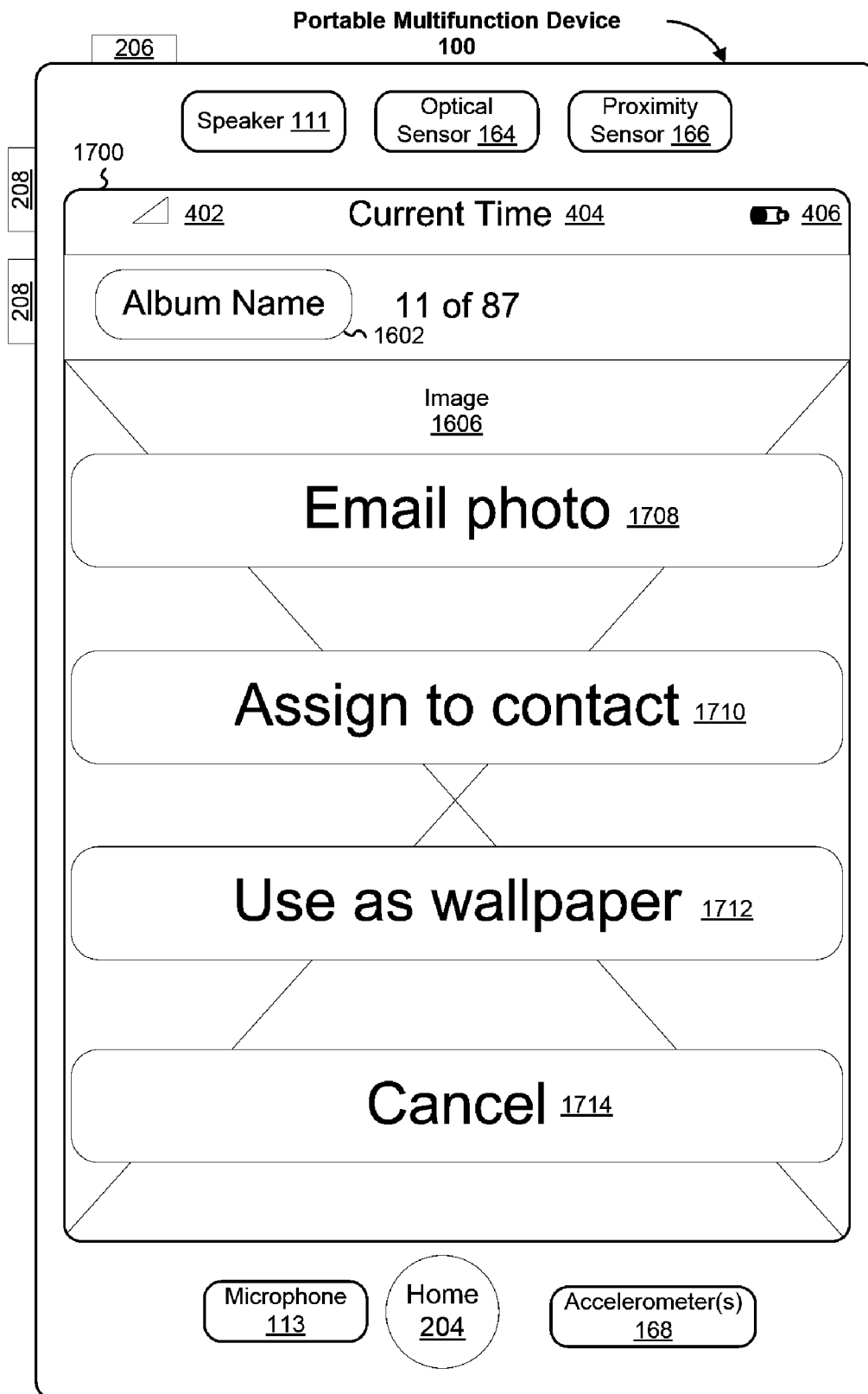


Figure 17

U.S. Patent

Jan. 20, 2009

Sheet 37 of 293

US 7,479,949 B2

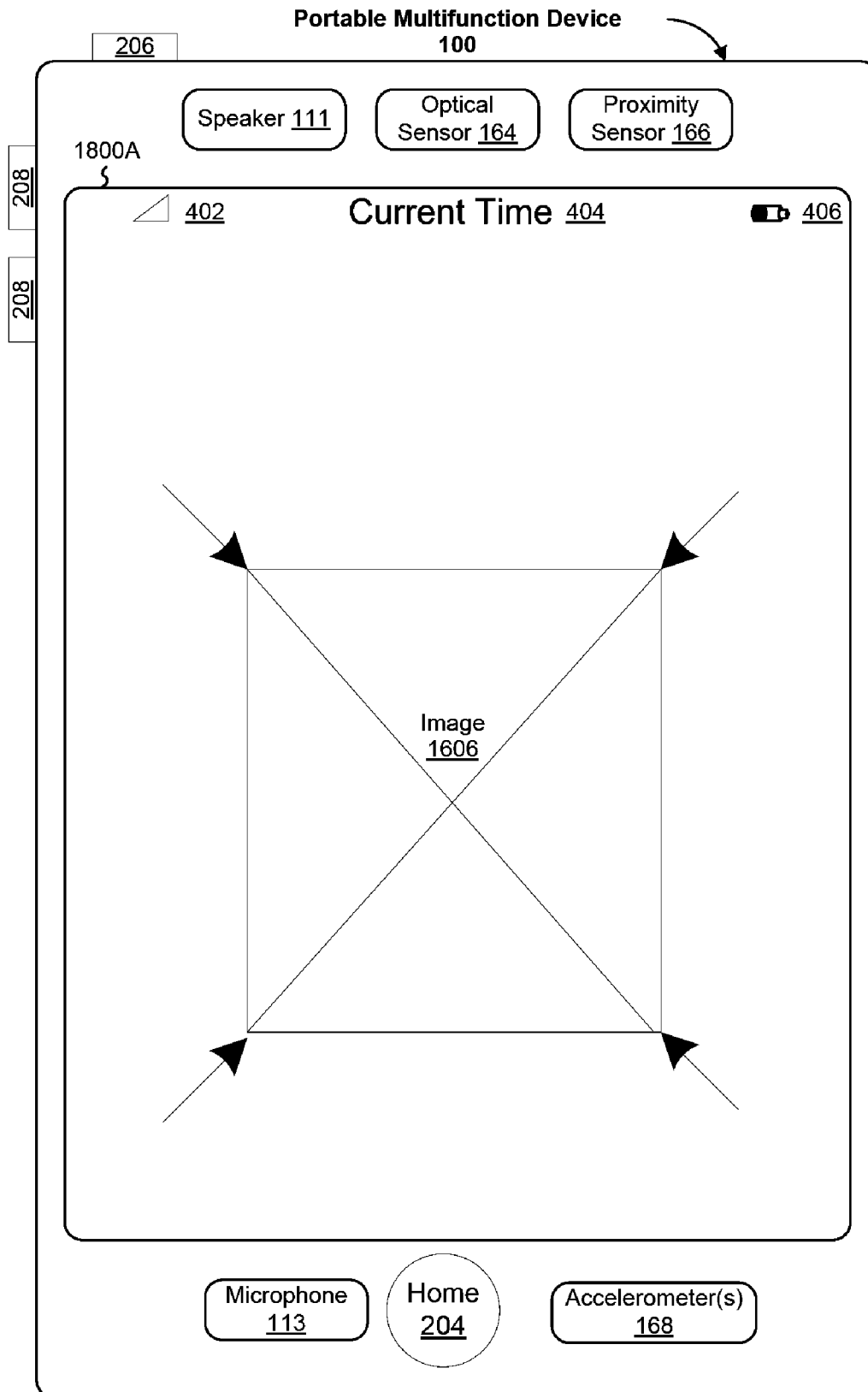


Figure 18A

U.S. Patent

Jan. 20, 2009

Sheet 38 of 293

US 7,479,949 B2

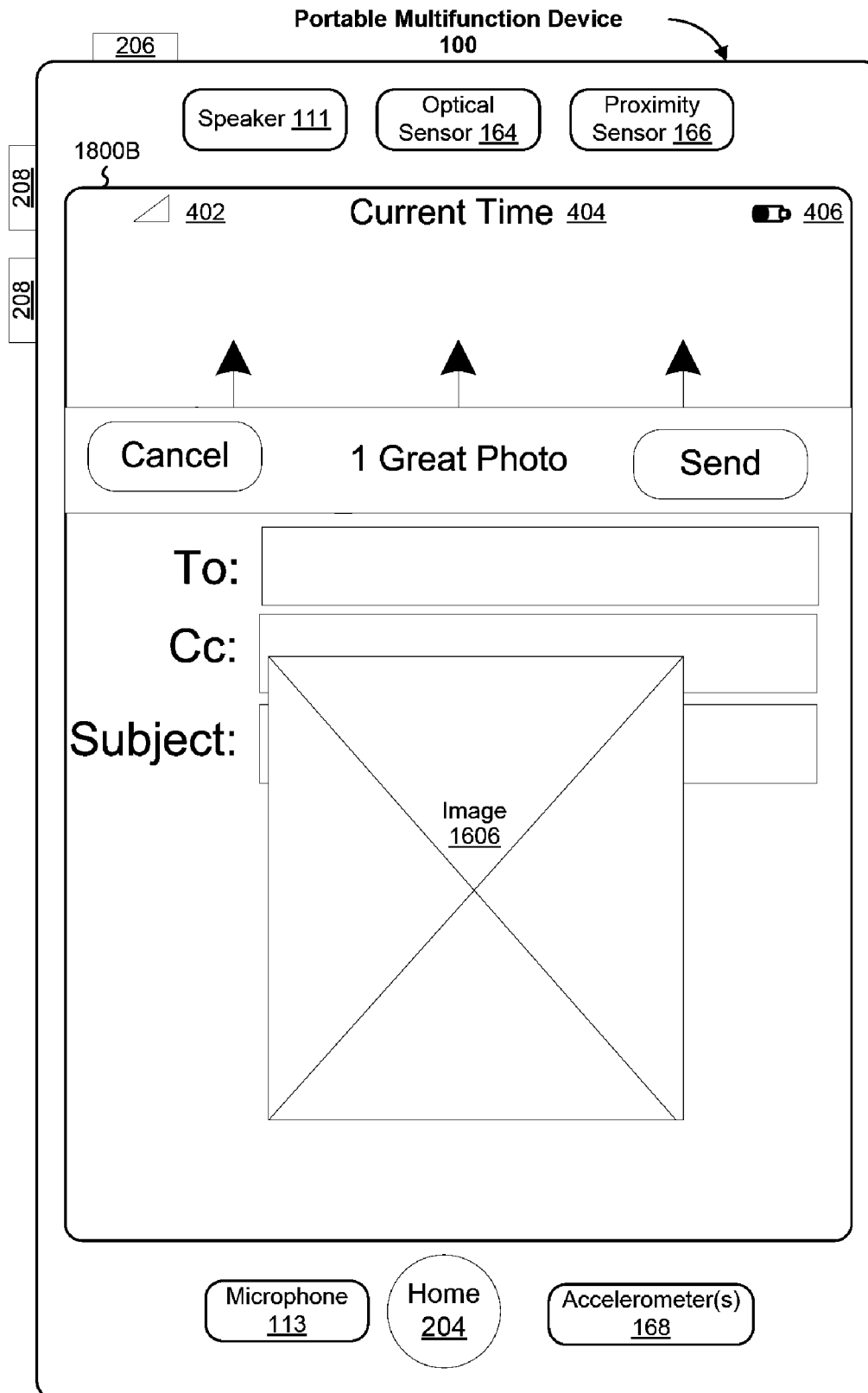


Figure 18B

U.S. Patent

Jan. 20, 2009

Sheet 39 of 293

US 7,479,949 B2

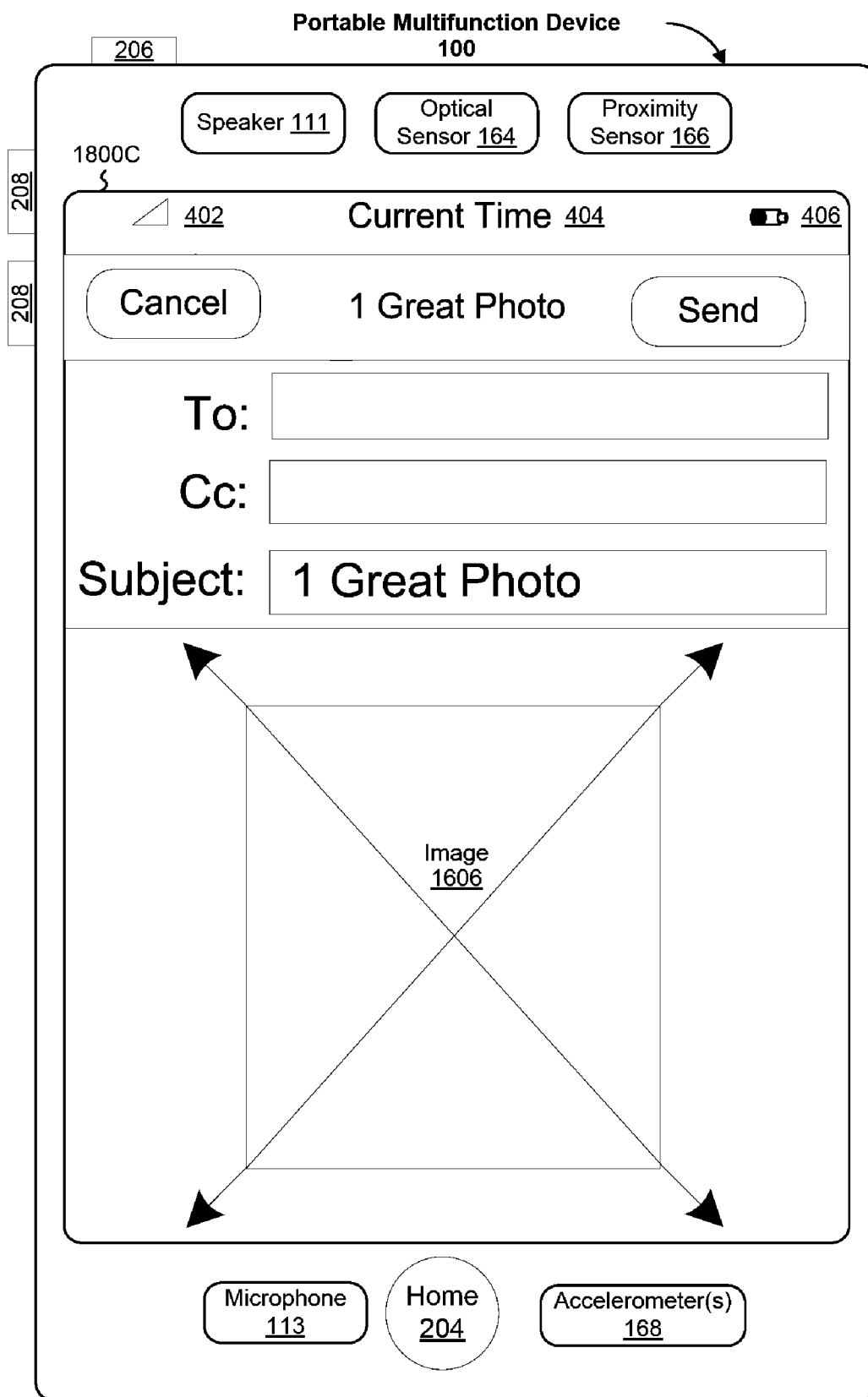


Figure 18C

U.S. Patent

Jan. 20, 2009

Sheet 40 of 293

US 7,479,949 B2

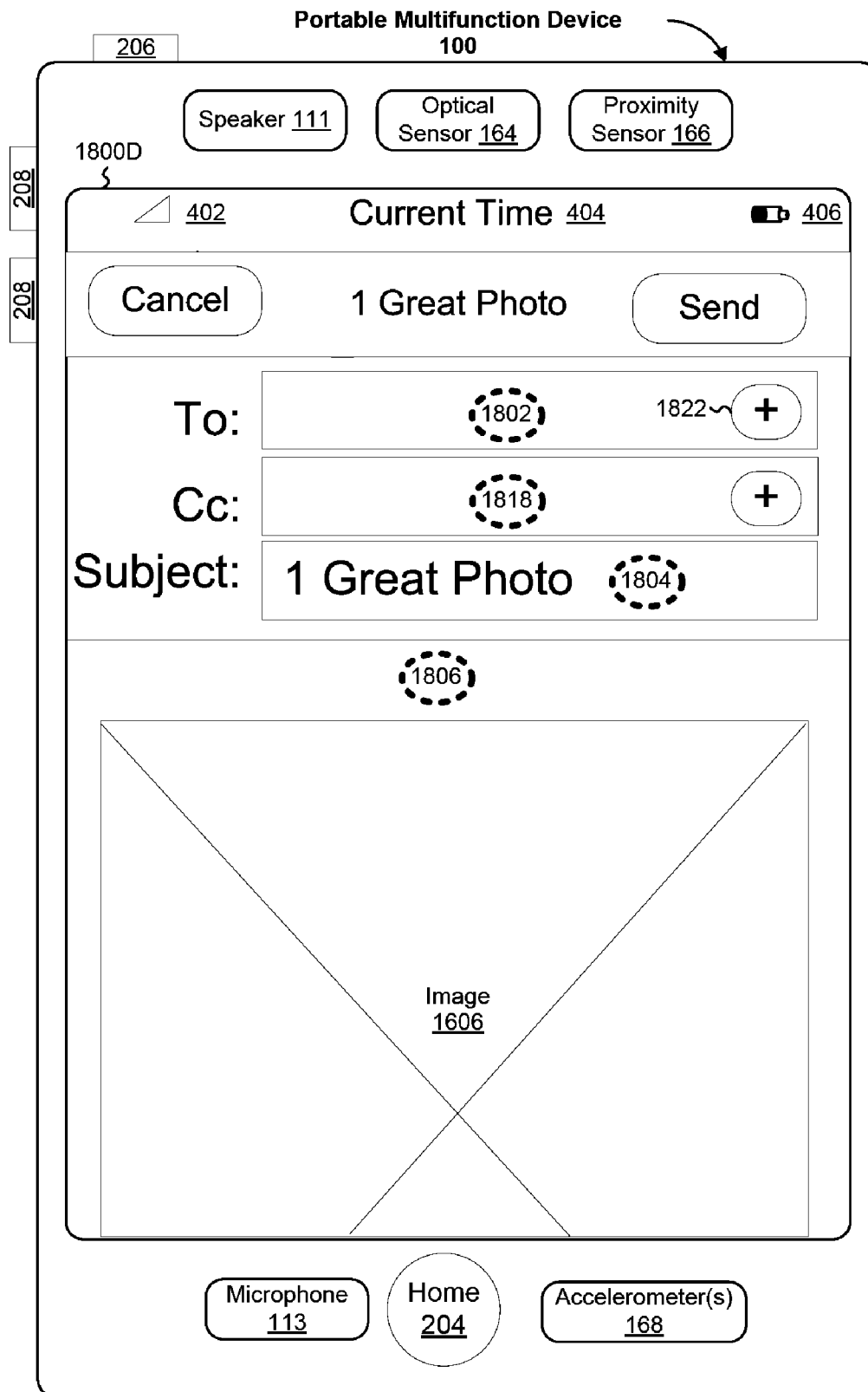


Figure 18D

U.S. Patent

Jan. 20, 2009

Sheet 41 of 293

US 7,479,949 B2

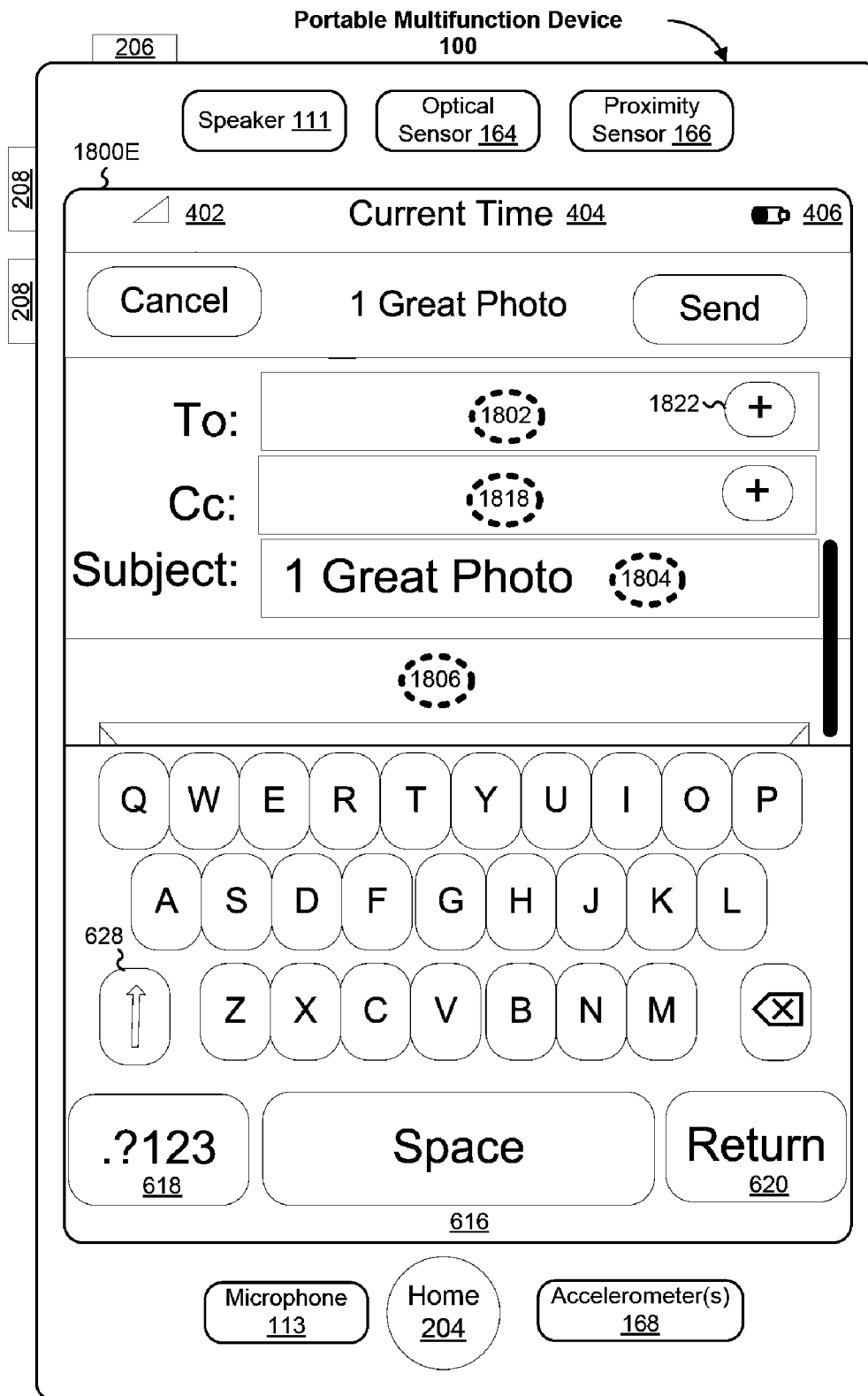


Figure 18E

U.S. Patent

Jan. 20, 2009

Sheet 42 of 293

US 7,479,949 B2

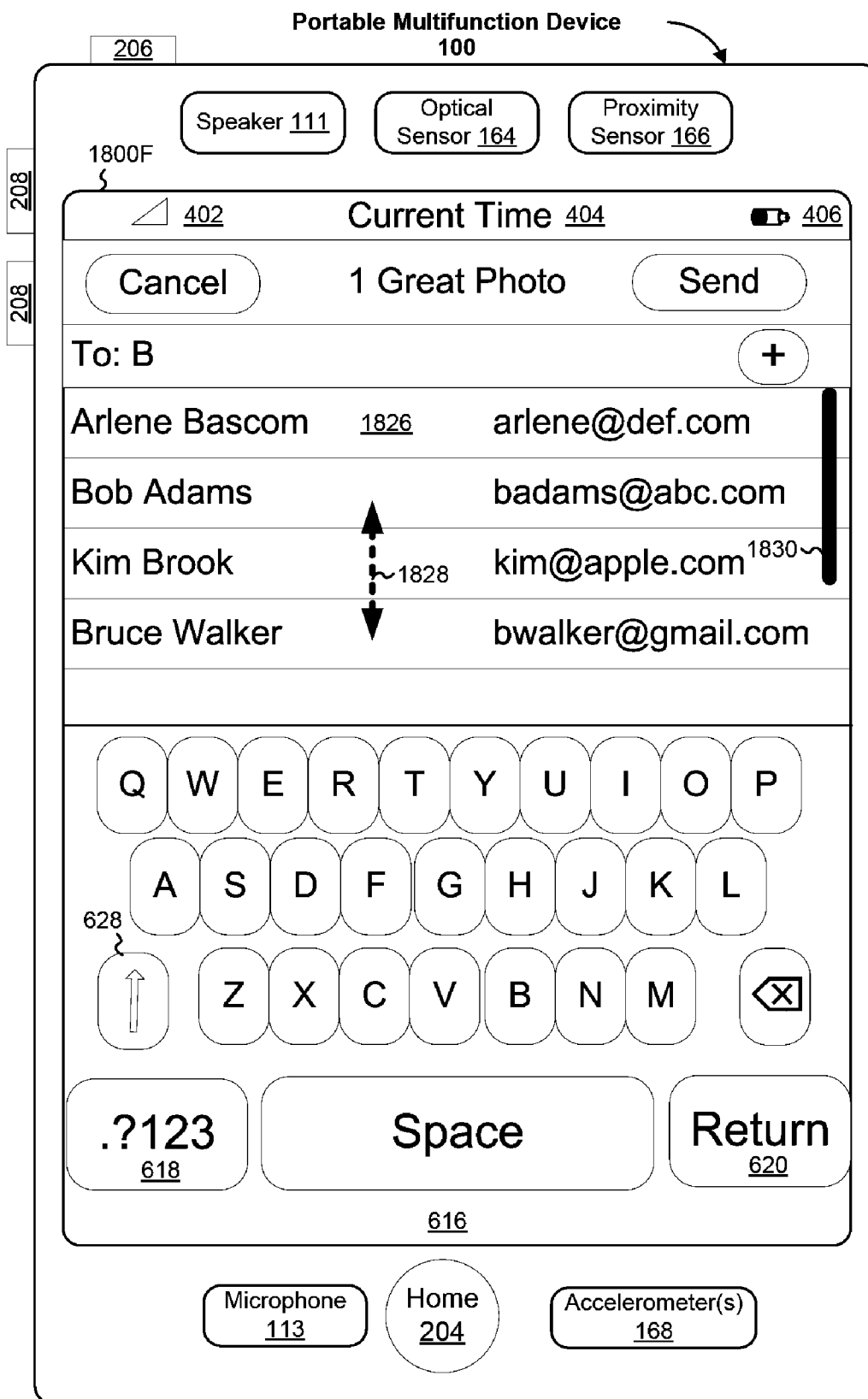


Figure 18F

U.S. Patent

Jan. 20, 2009

Sheet 43 of 293

US 7,479,949 B2

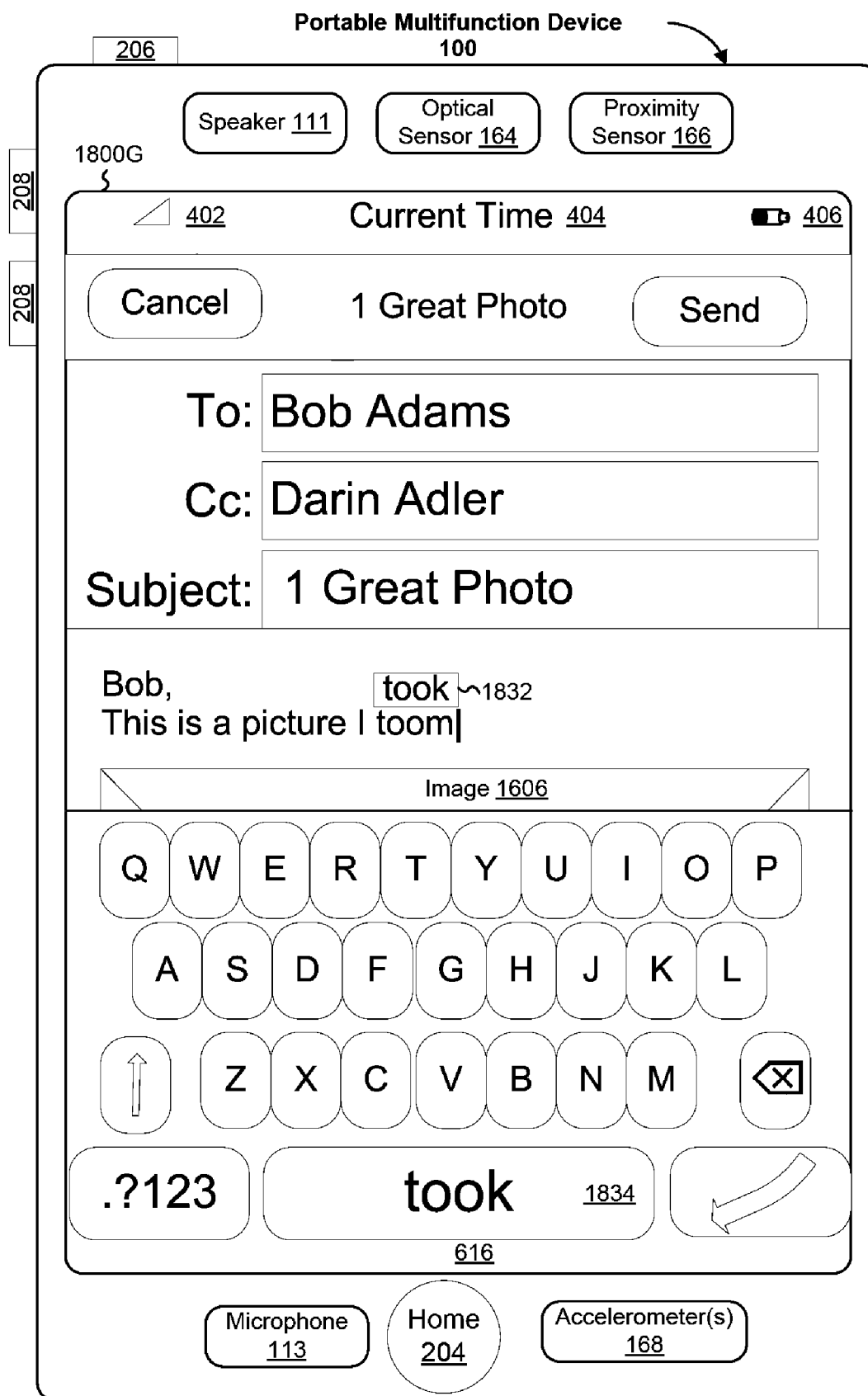


Figure 18G

U.S. Patent

Jan. 20, 2009

Sheet 44 of 293

US 7,479,949 B2

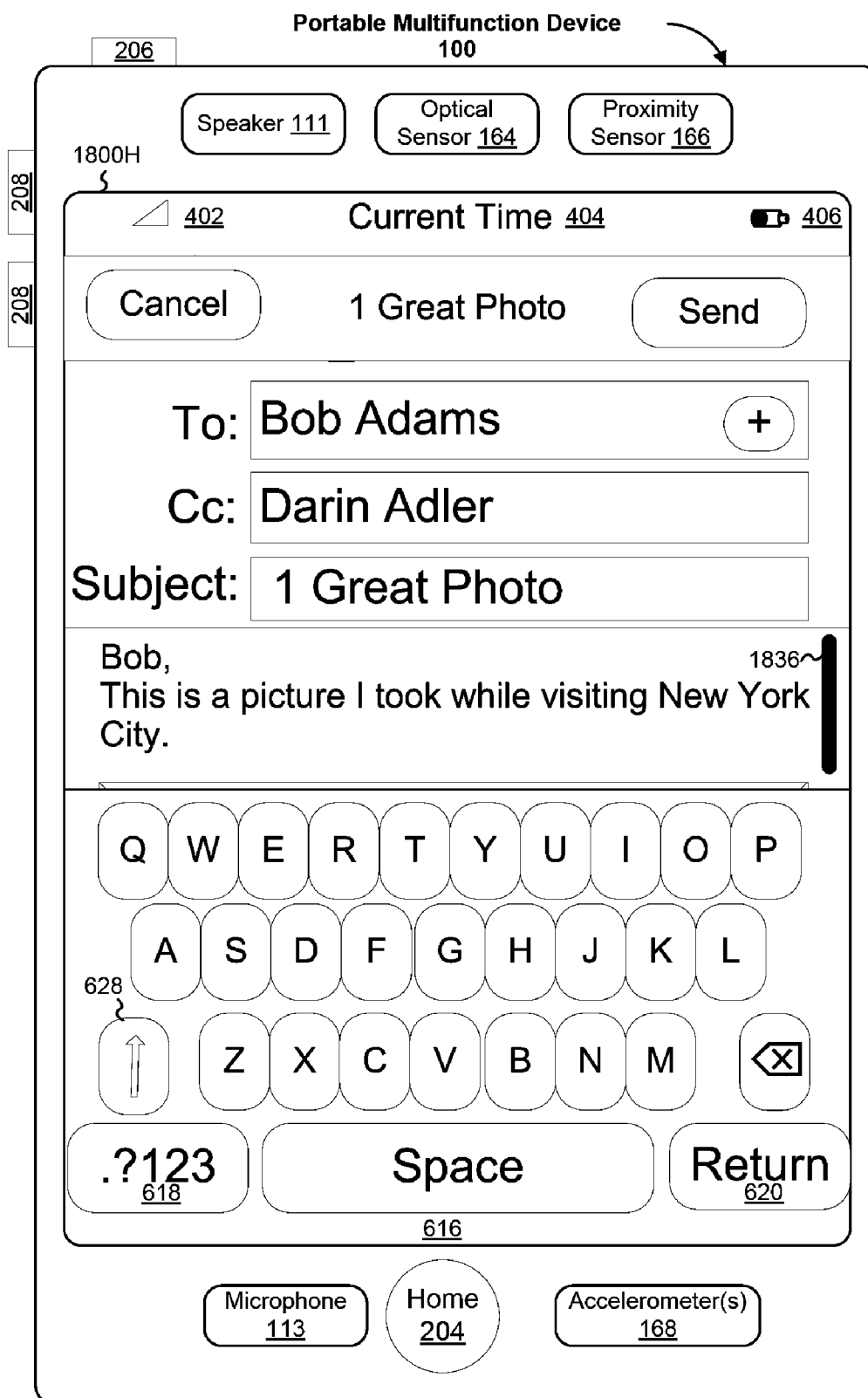


Figure 18H

U.S. Patent

Jan. 20, 2009

Sheet 45 of 293

US 7,479,949 B2

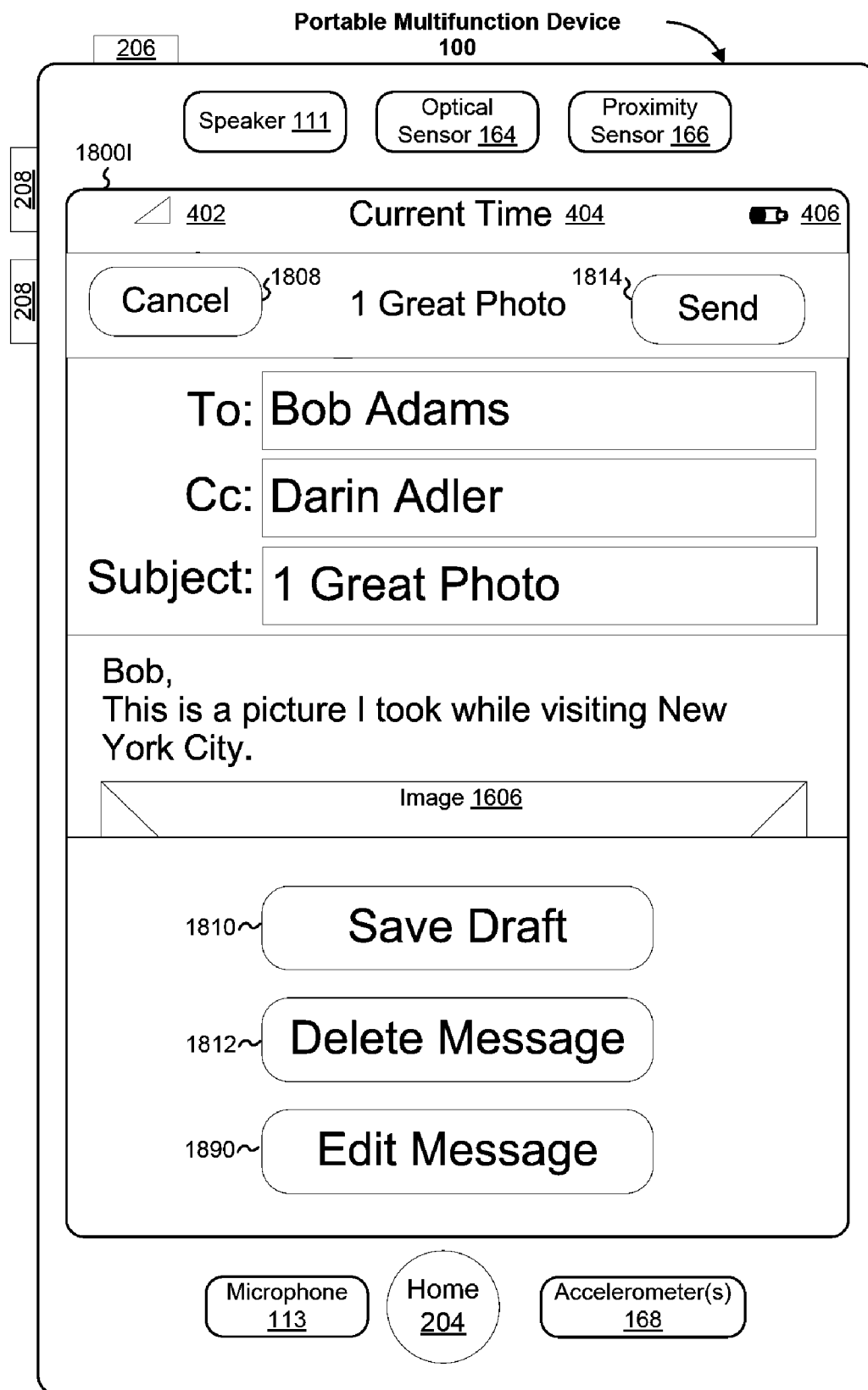


Figure 18I

U.S. Patent

Jan. 20, 2009

Sheet 46 of 293

US 7,479,949 B2

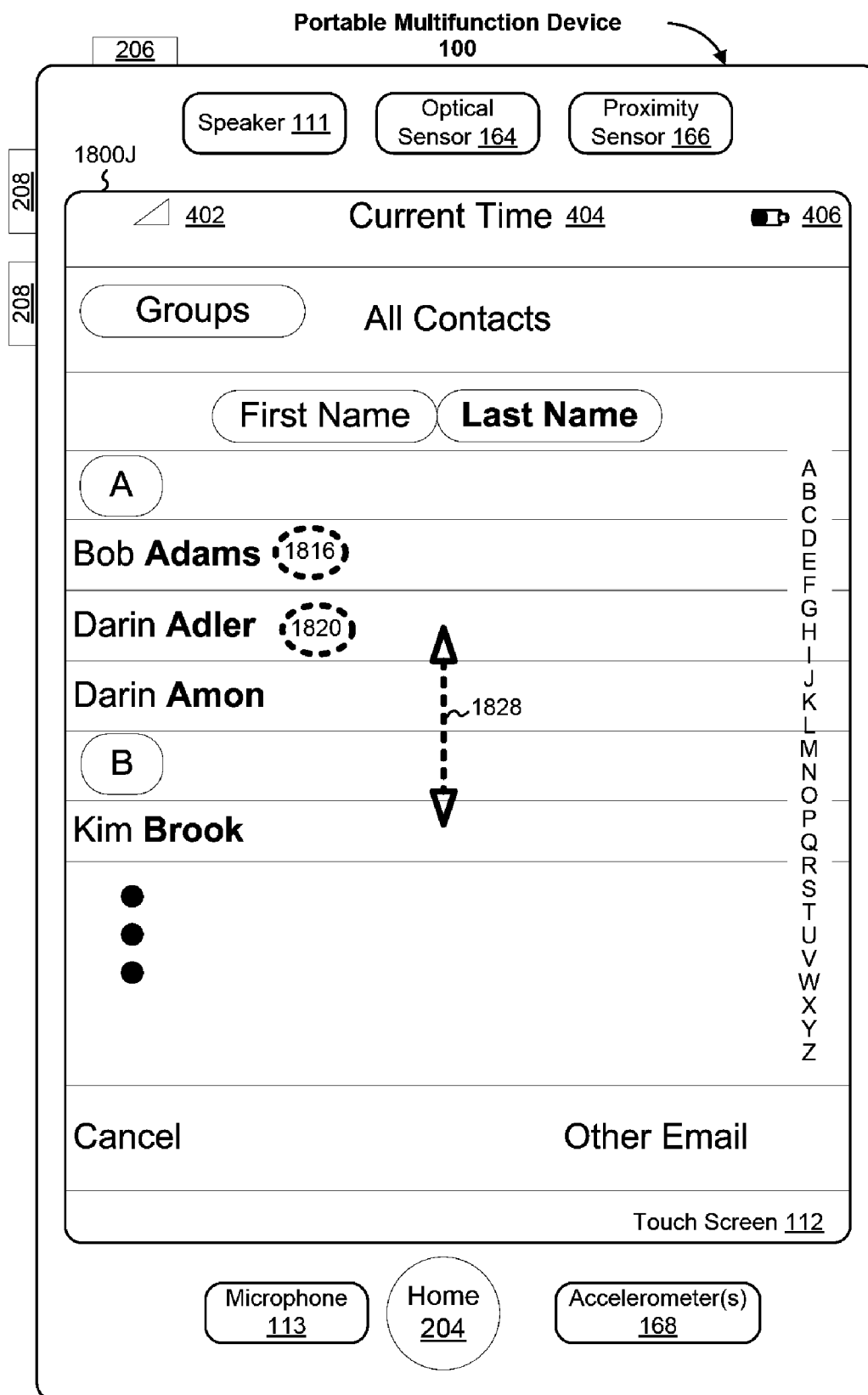


Figure 18J

U.S. Patent

Jan. 20, 2009

Sheet 47 of 293

US 7,479,949 B2

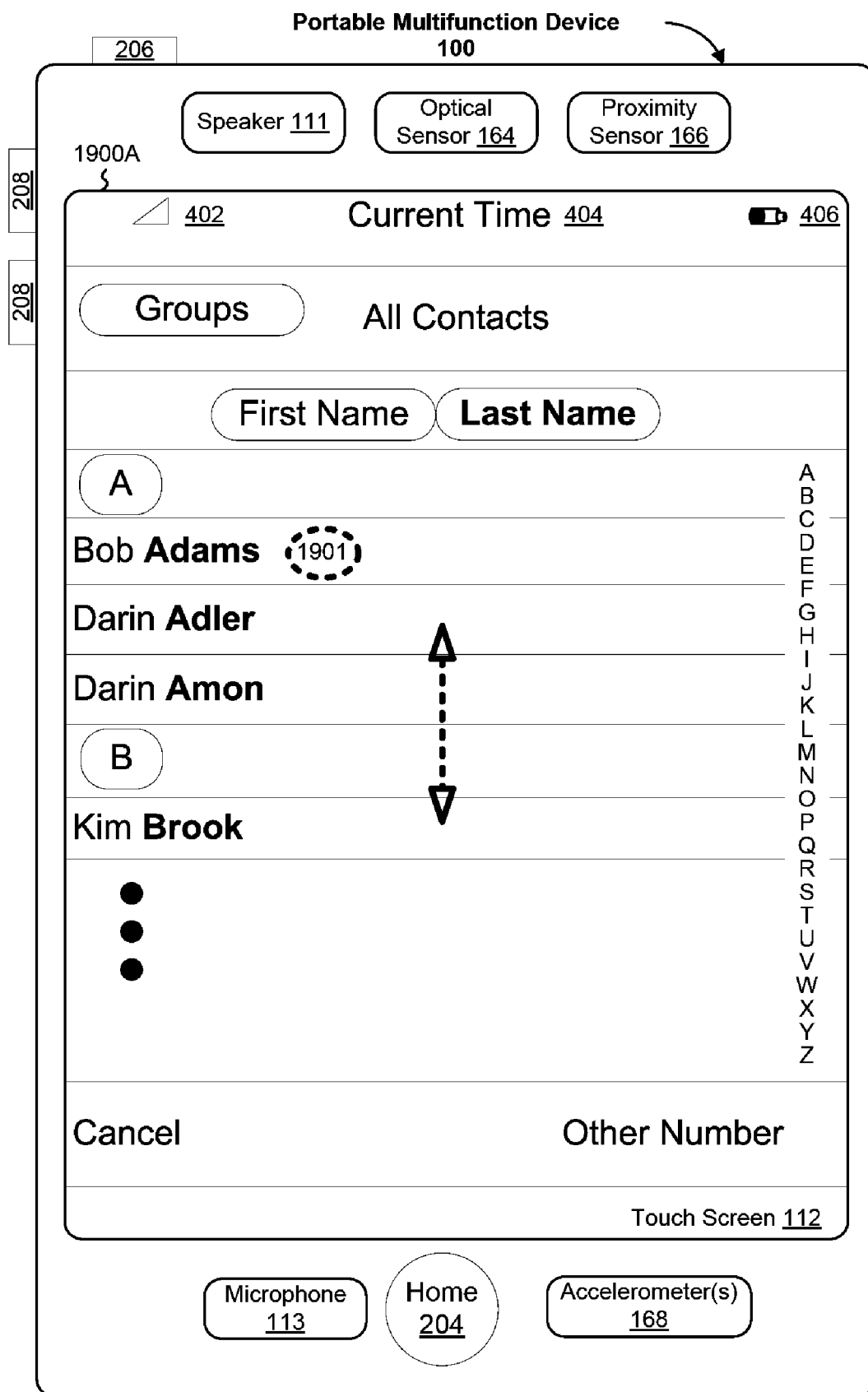


Figure 19A

U.S. Patent

Jan. 20, 2009

Sheet 48 of 293

US 7,479,949 B2

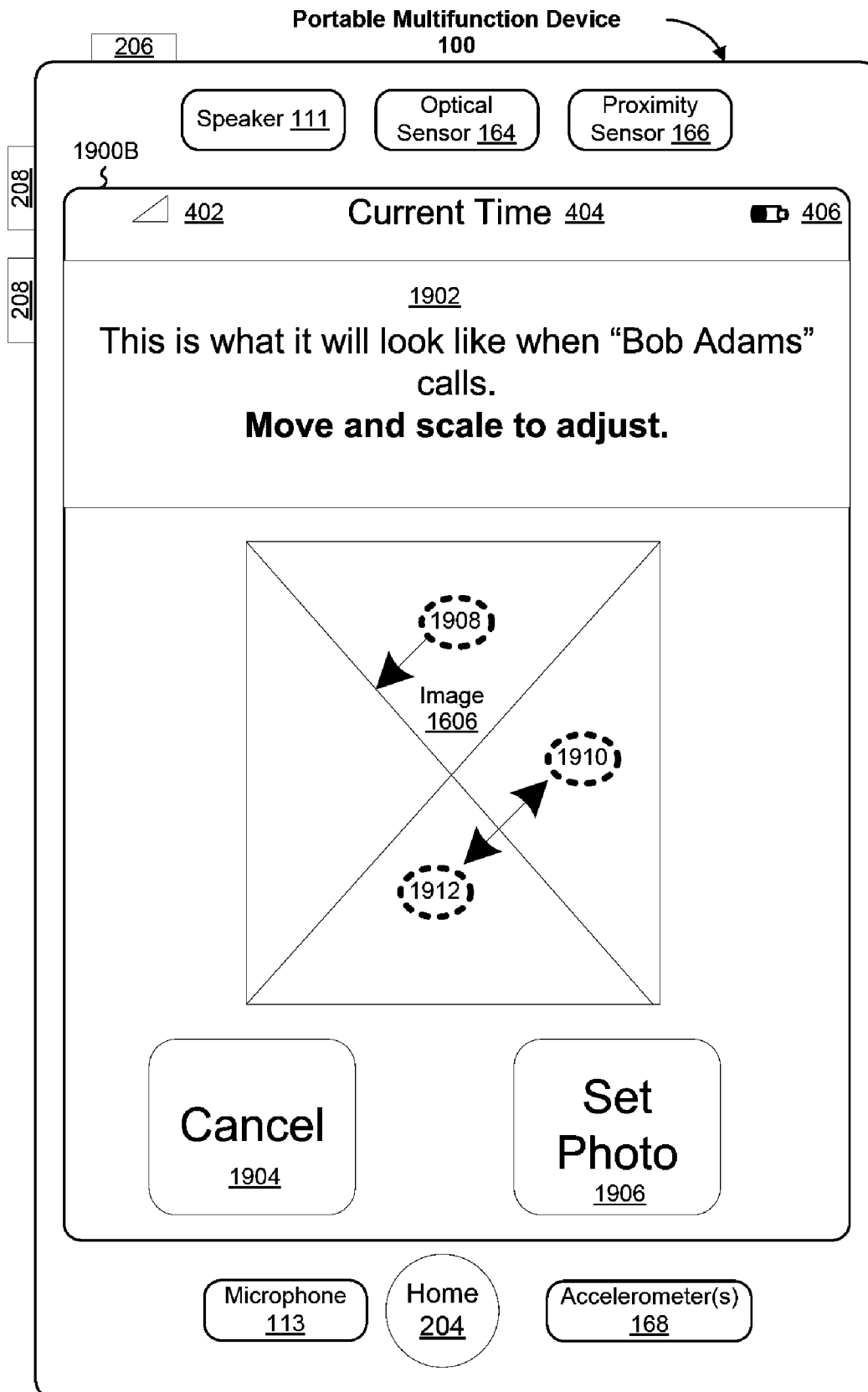


Figure 19B

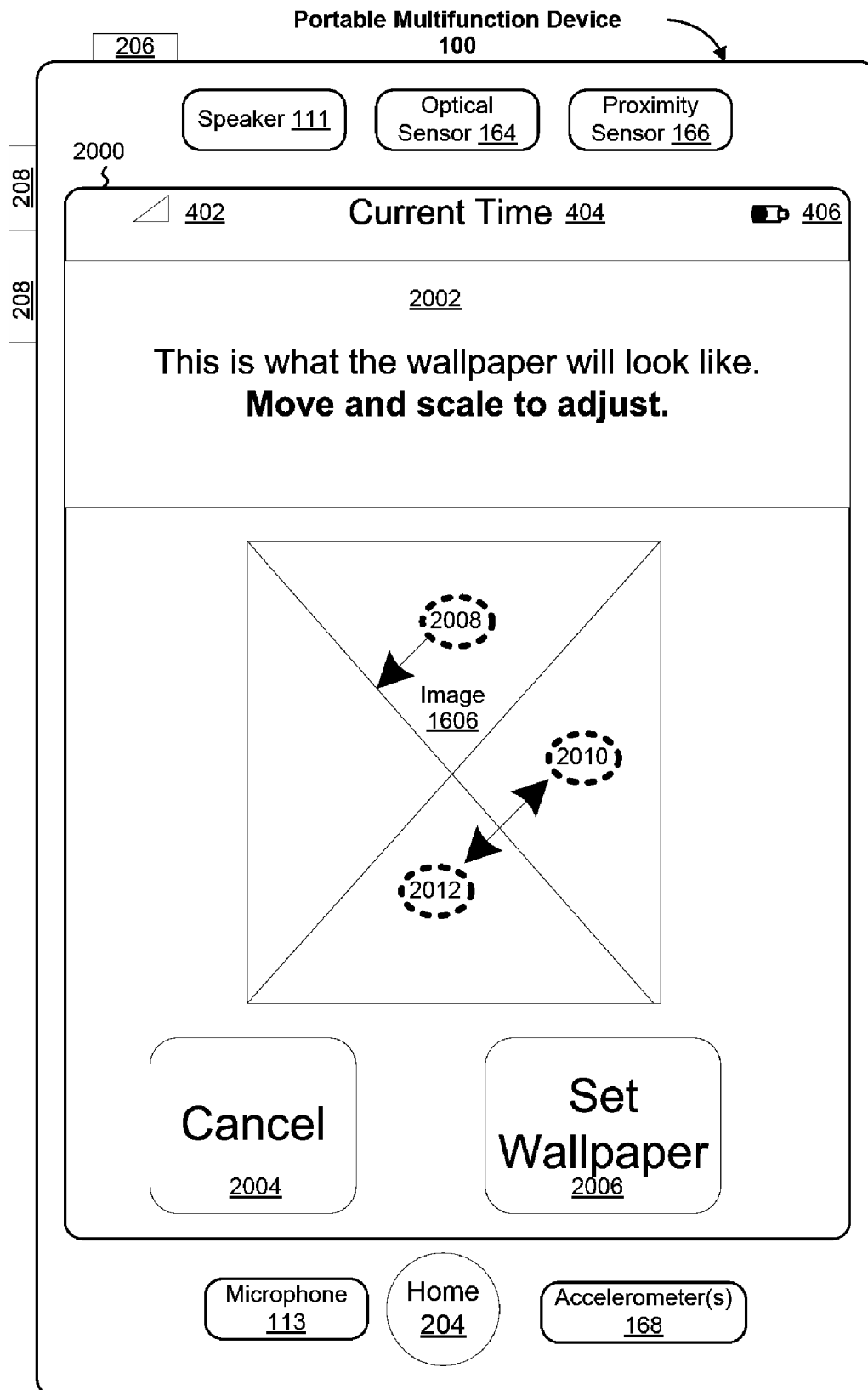


Figure 20

U.S. Patent

Jan. 20, 2009

Sheet 50 of 293

US 7,479,949 B2

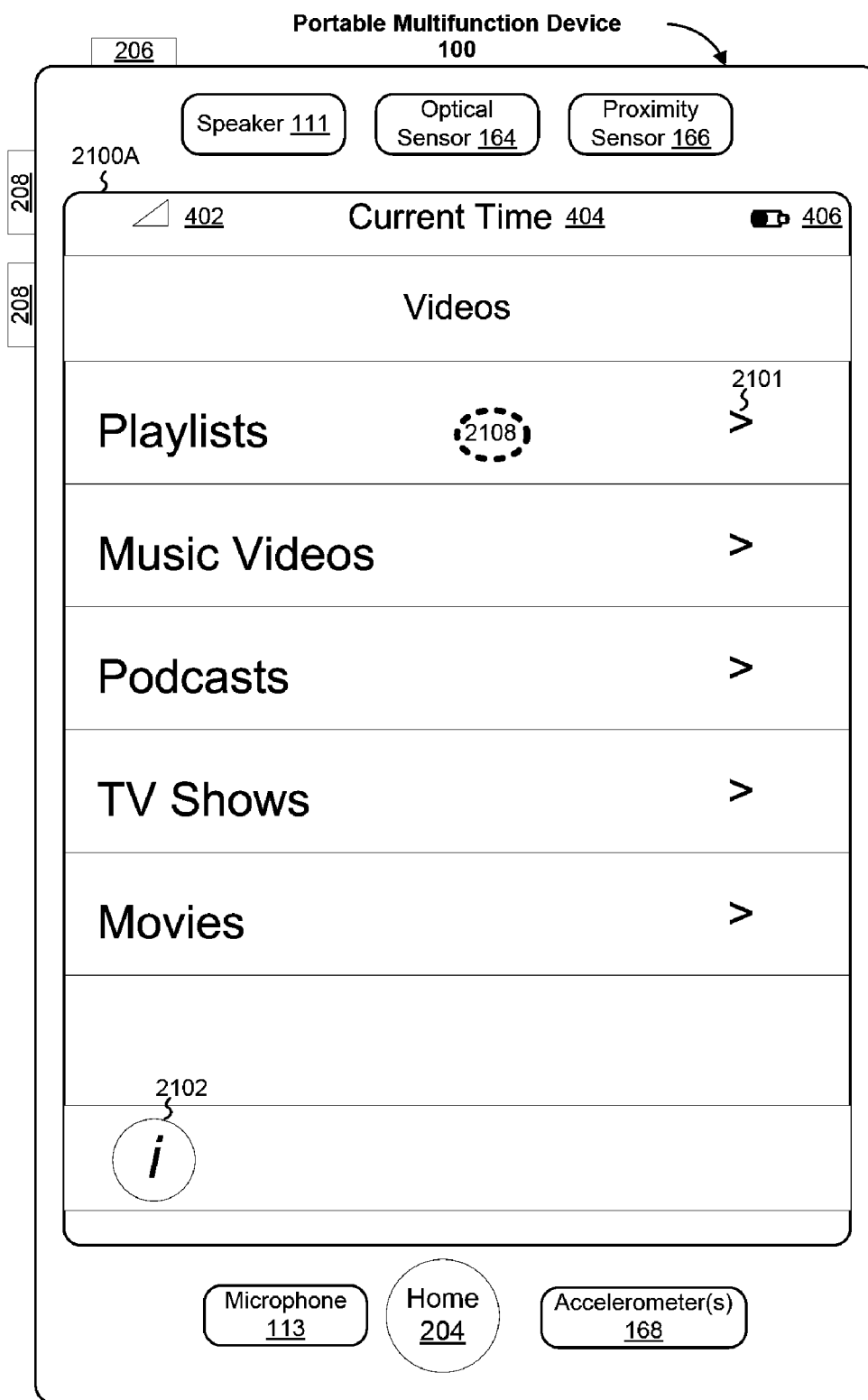


Figure 21A

U.S. Patent

Jan. 20, 2009

Sheet 51 of 293

US 7,479,949 B2

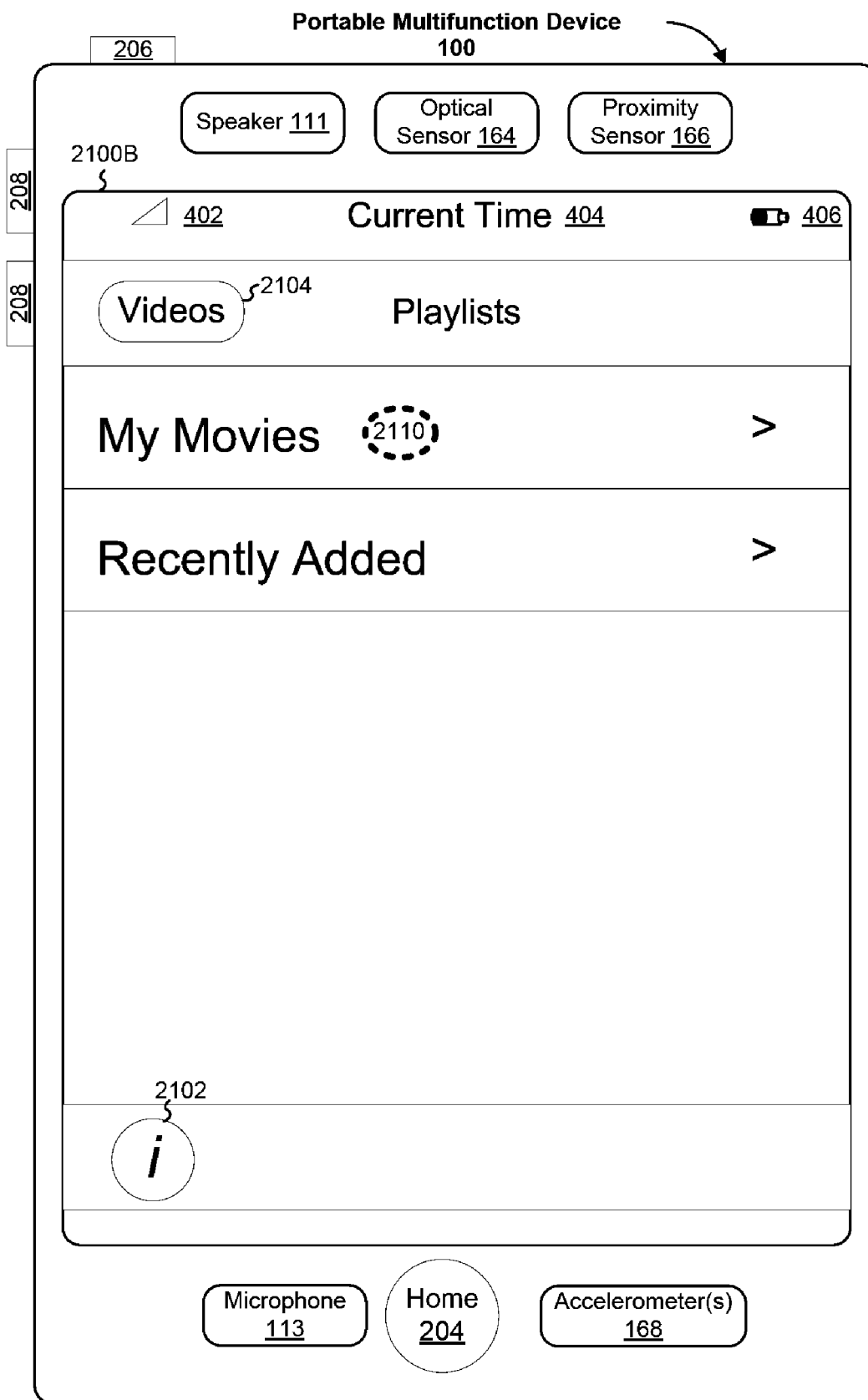


Figure 21B

U.S. Patent

Jan. 20, 2009

Sheet 52 of 293

US 7,479,949 B2

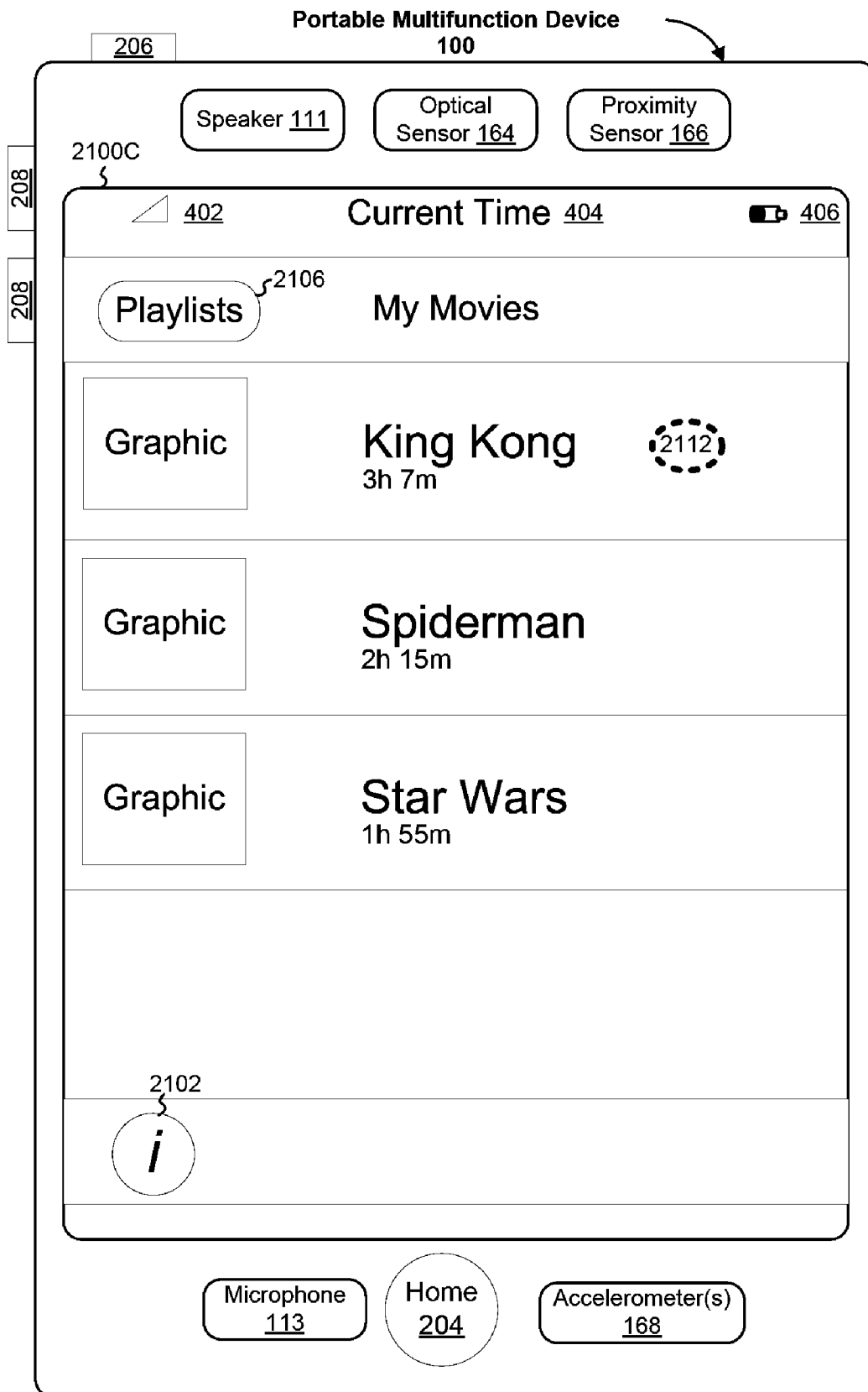


Figure 21C

U.S. Patent

Jan. 20, 2009

Sheet 53 of 293

US 7,479,949 B2

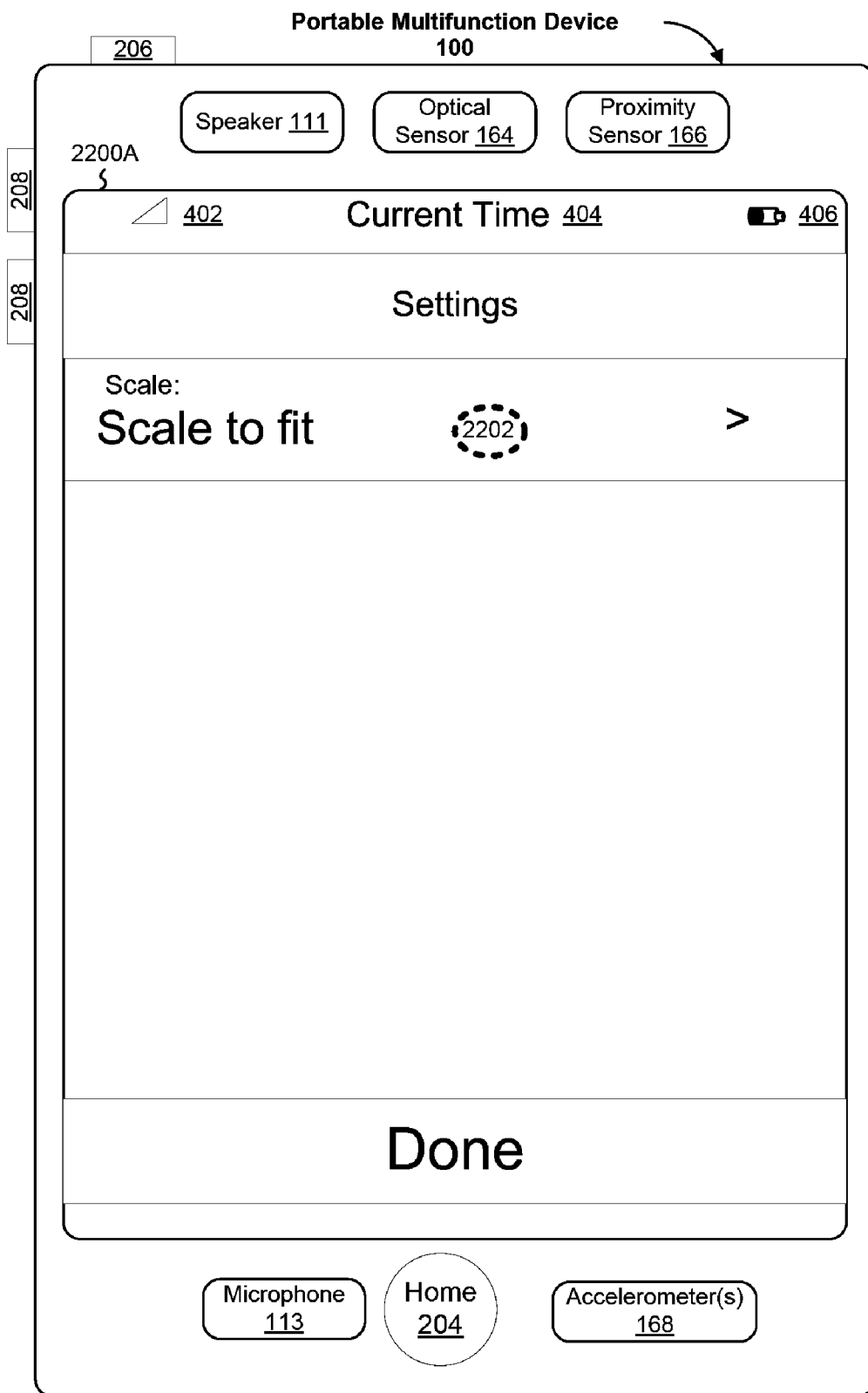


Figure 22A

U.S. Patent

Jan. 20, 2009

Sheet 54 of 293

US 7,479,949 B2

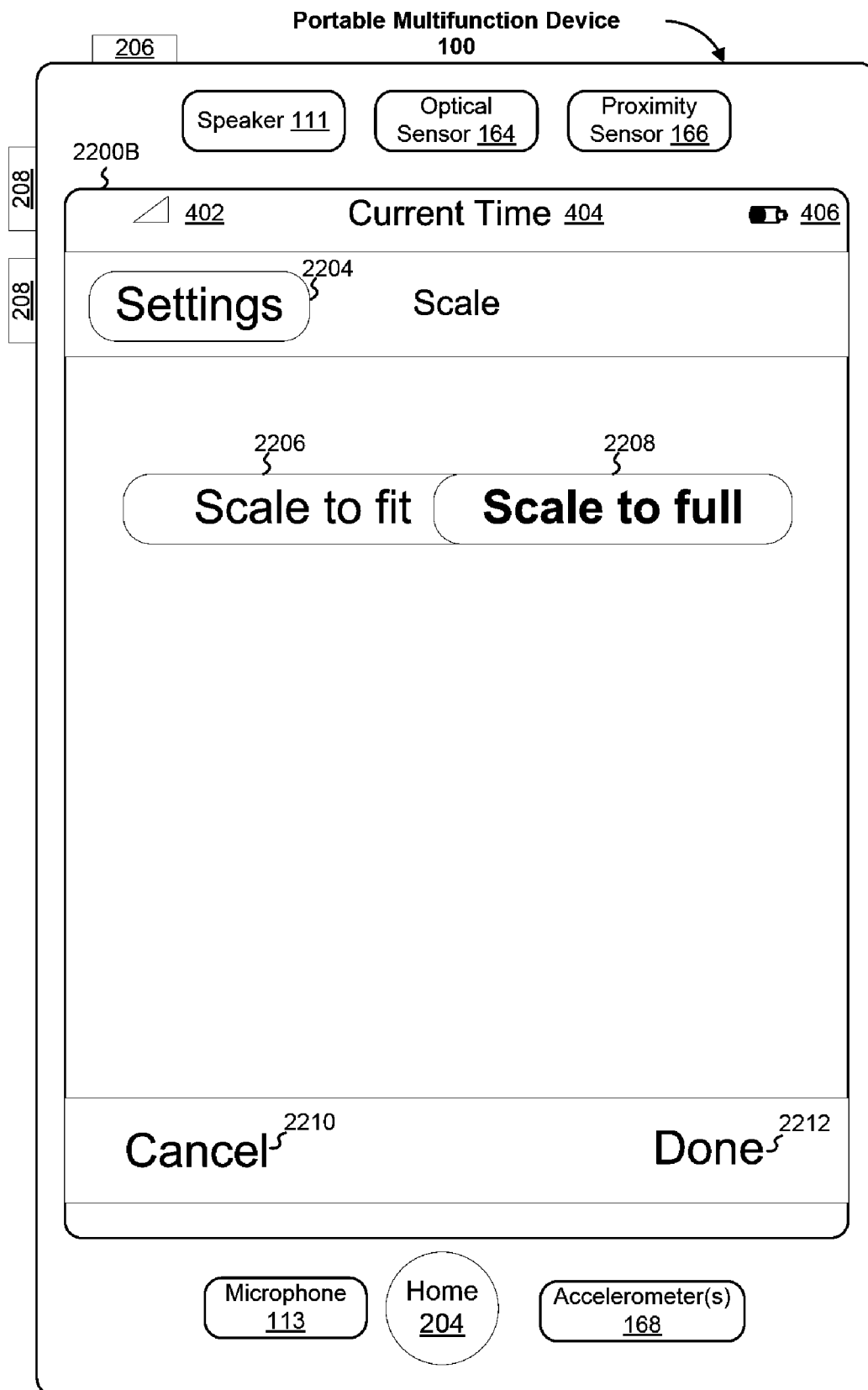


Figure 22B

U.S. Patent

Jan. 20, 2009

Sheet 55 of 293

US 7,479,949 B2

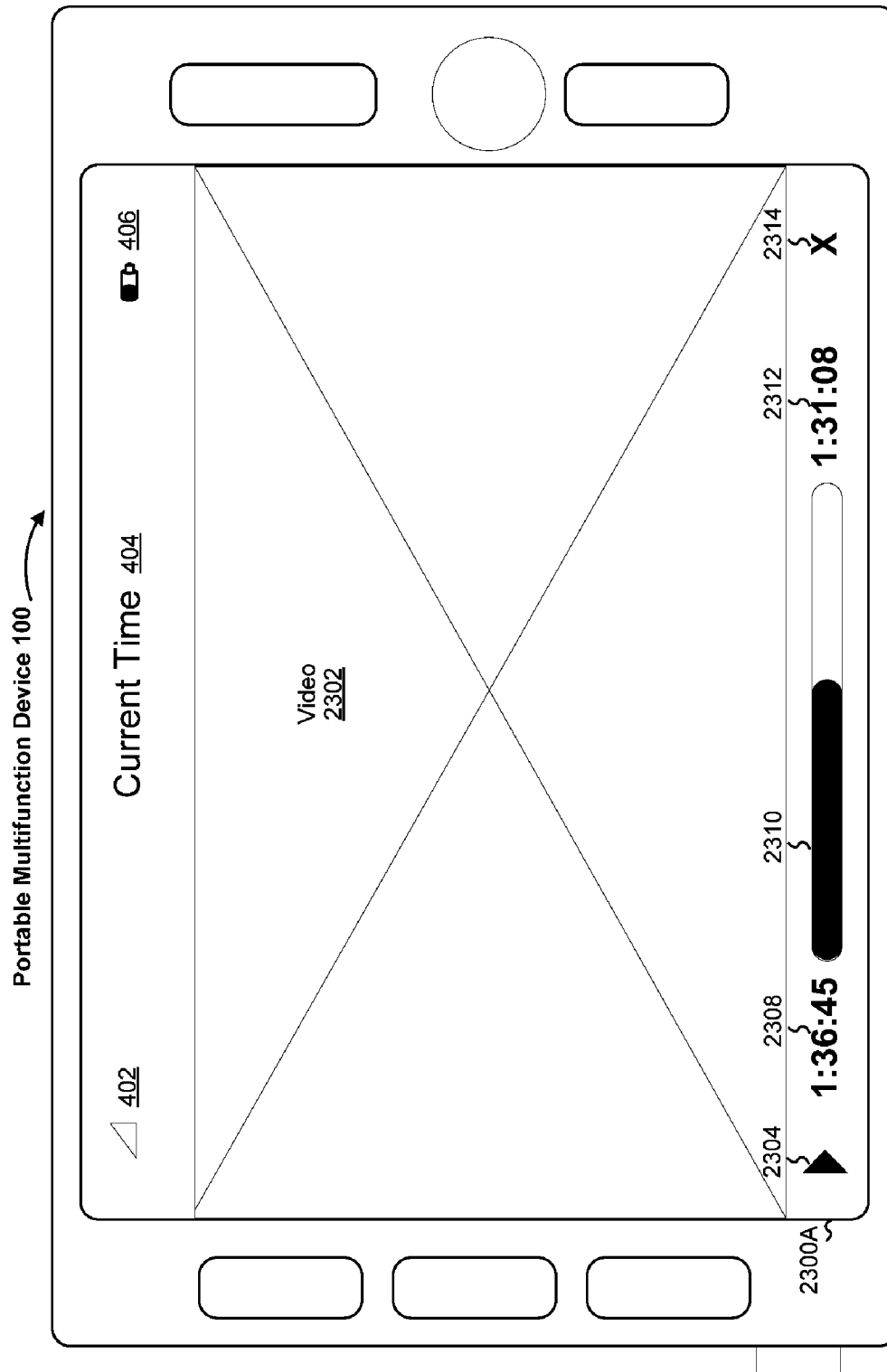


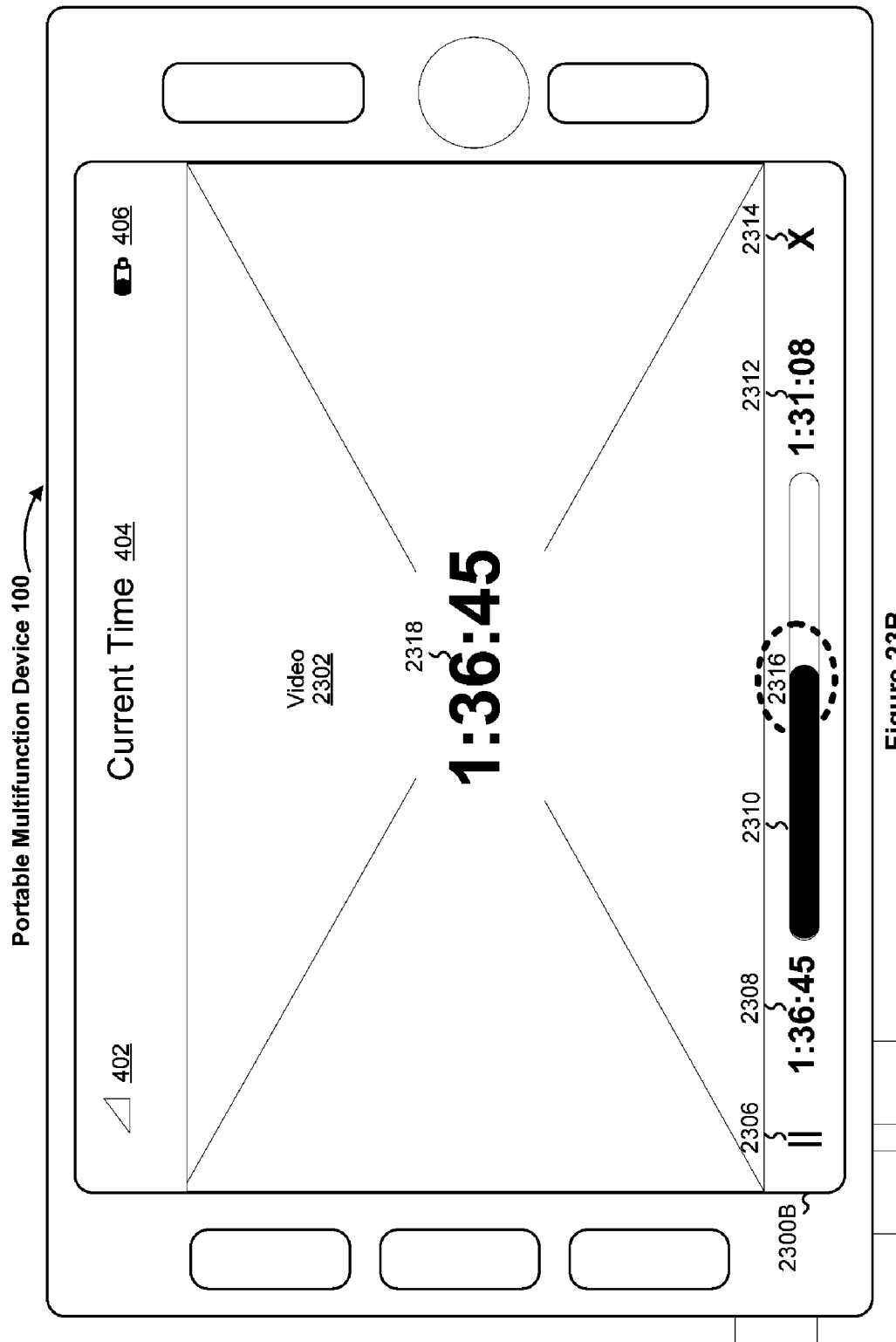
Figure 23A

U.S. Patent

Jan. 20, 2009

Sheet 56 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 57 of 293

US 7,479,949 B2

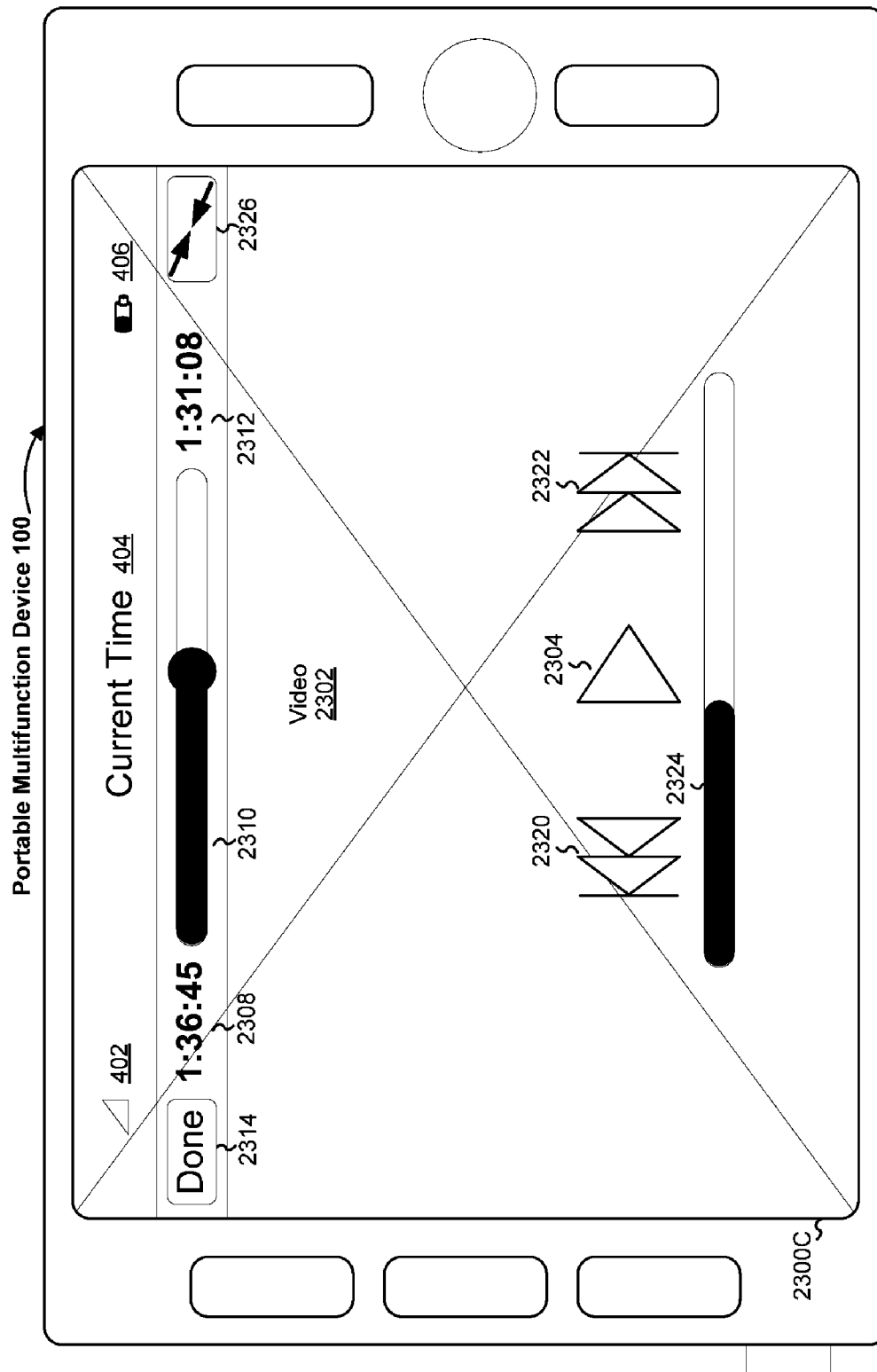
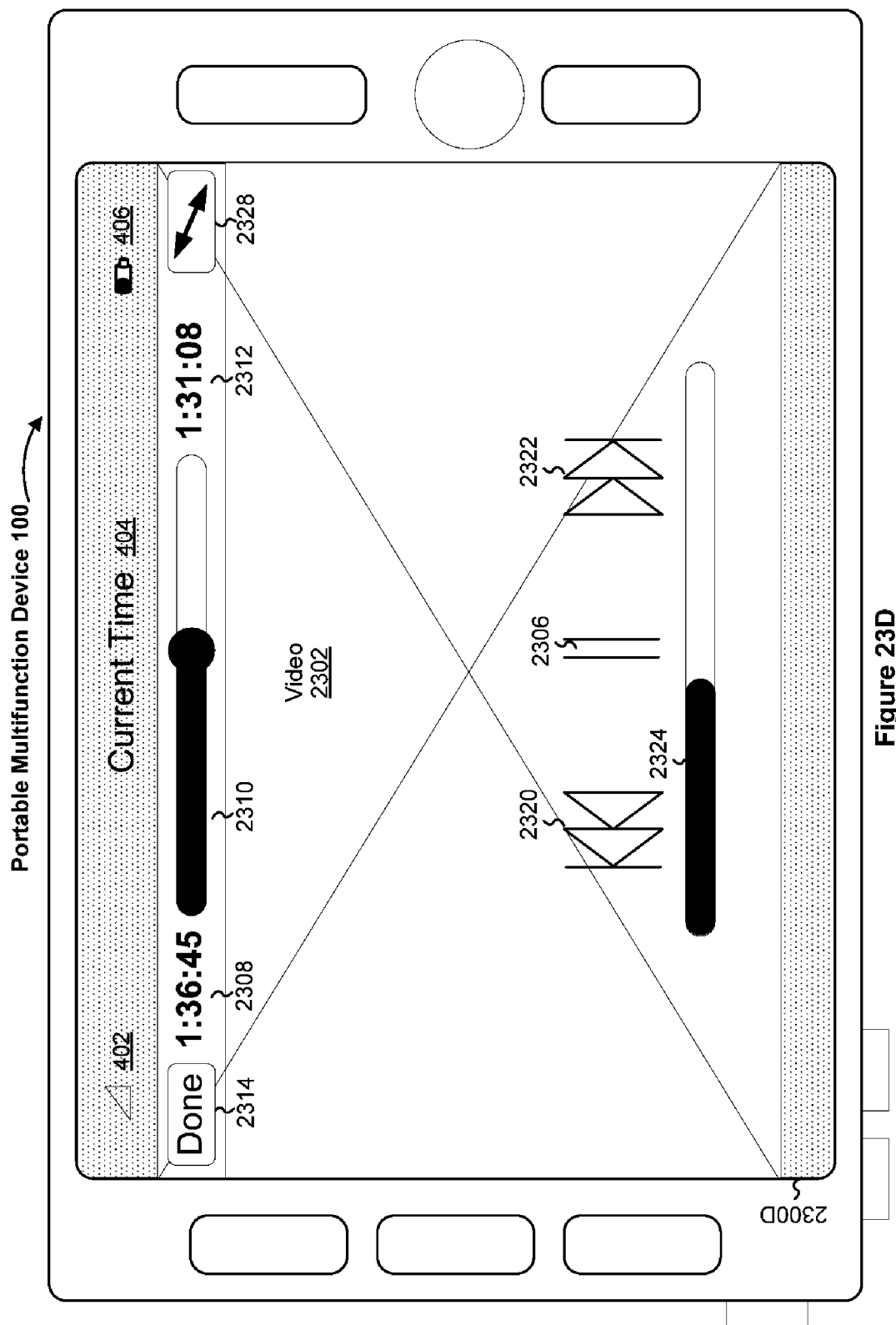


Figure 23C



U.S. Patent

Jan. 20, 2009

Sheet 59 of 293

US 7,479,949 B2

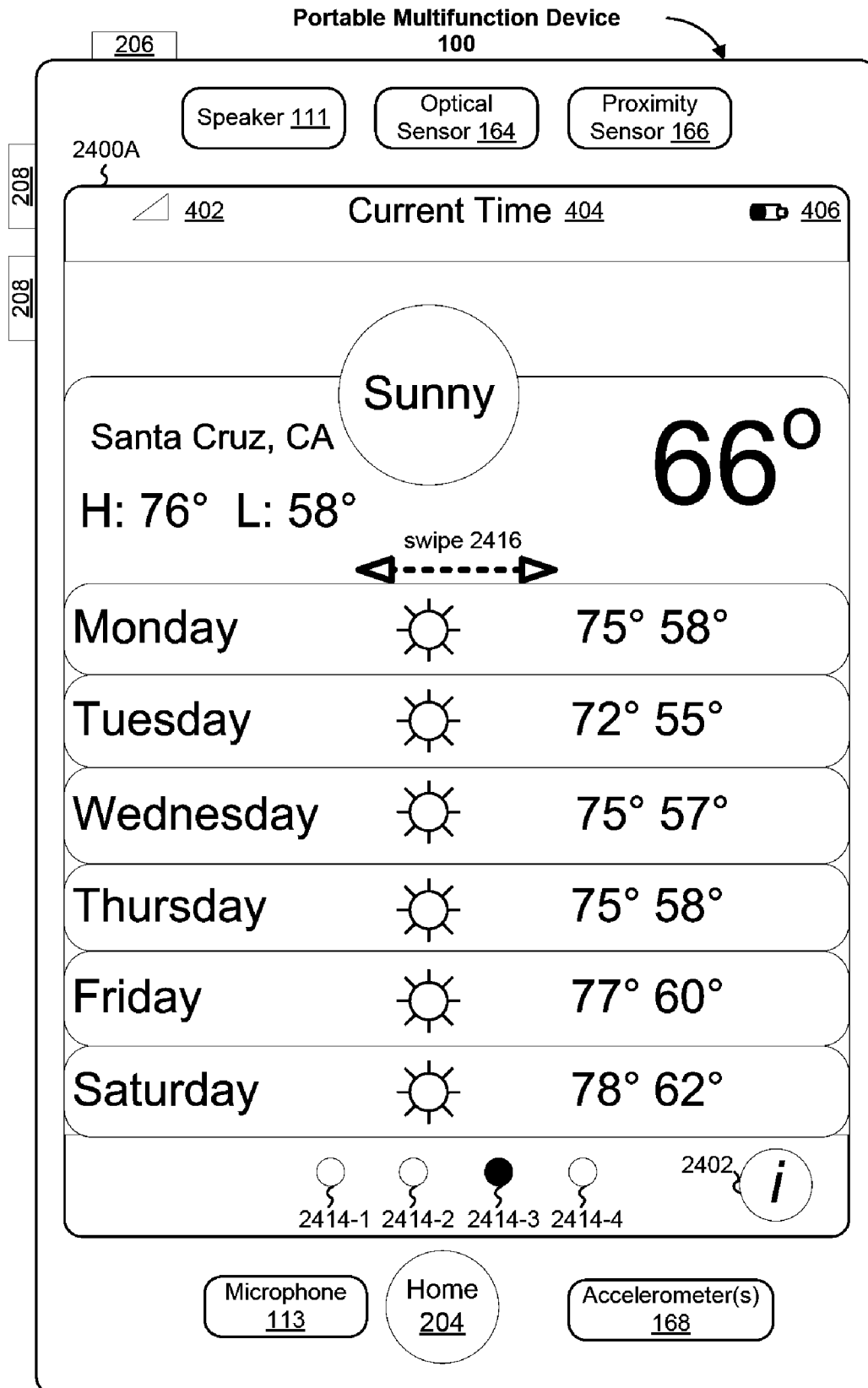


Figure 24A

U.S. Patent

Jan. 20, 2009

Sheet 60 of 293

US 7,479,949 B2

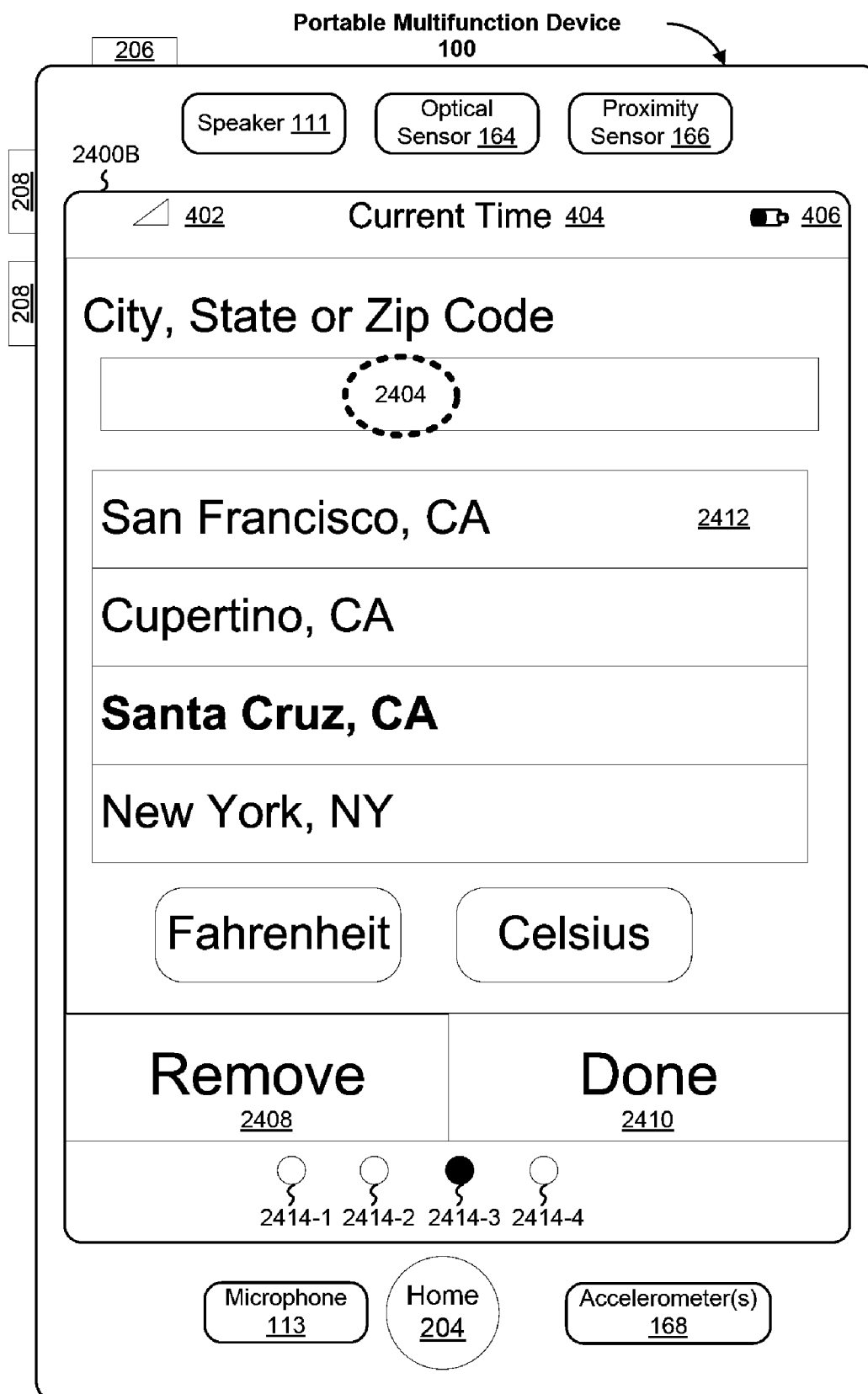


Figure 24B

U.S. Patent

Jan. 20, 2009

Sheet 61 of 293

US 7,479,949 B2

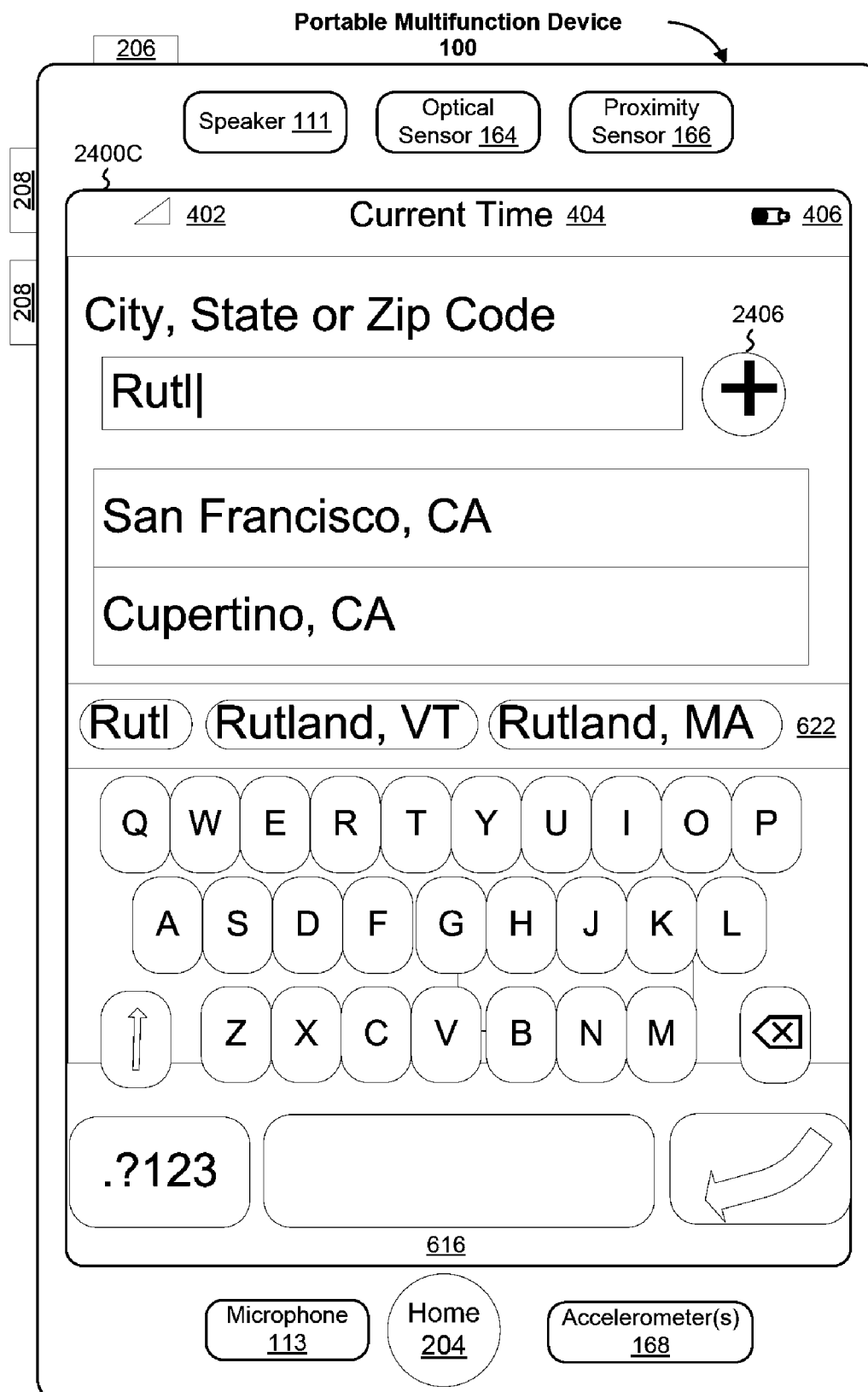


Figure 24C

U.S. Patent

Jan. 20, 2009

Sheet 62 of 293

US 7,479,949 B2

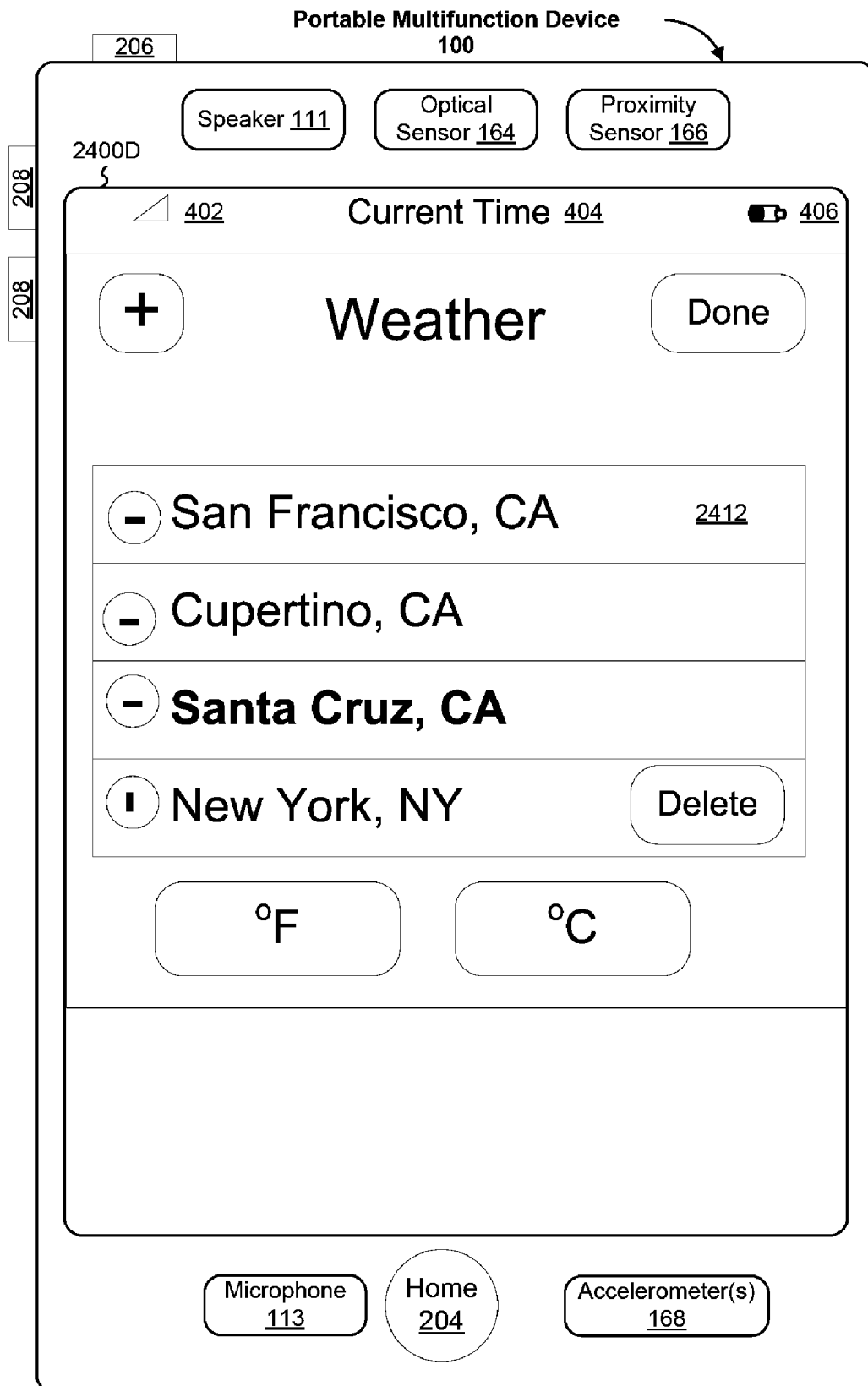


Figure 24D

U.S. Patent

Jan. 20, 2009

Sheet 63 of 293

US 7,479,949 B2

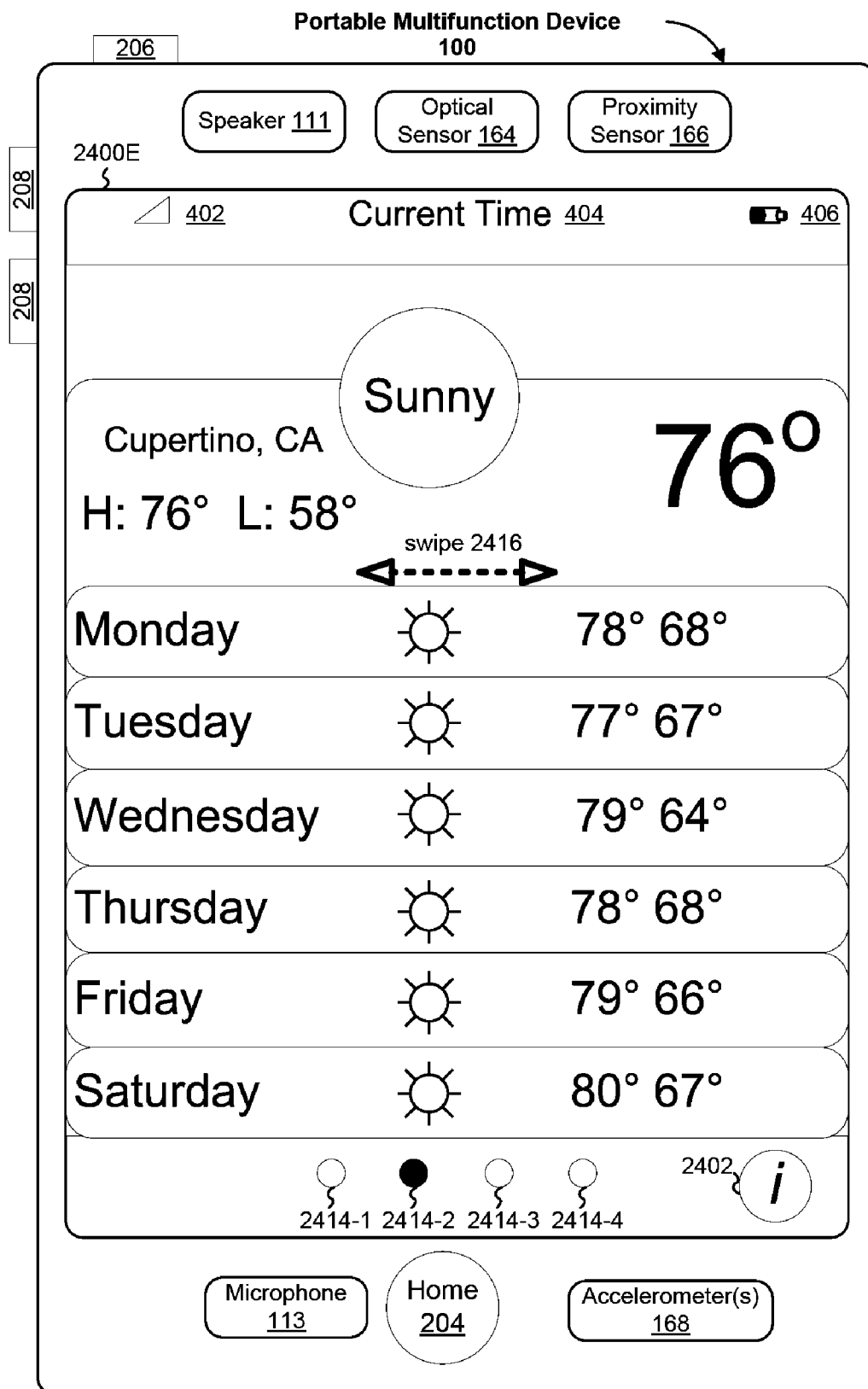


Figure 24E

U.S. Patent

Jan. 20, 2009

Sheet 64 of 293

US 7,479,949 B2

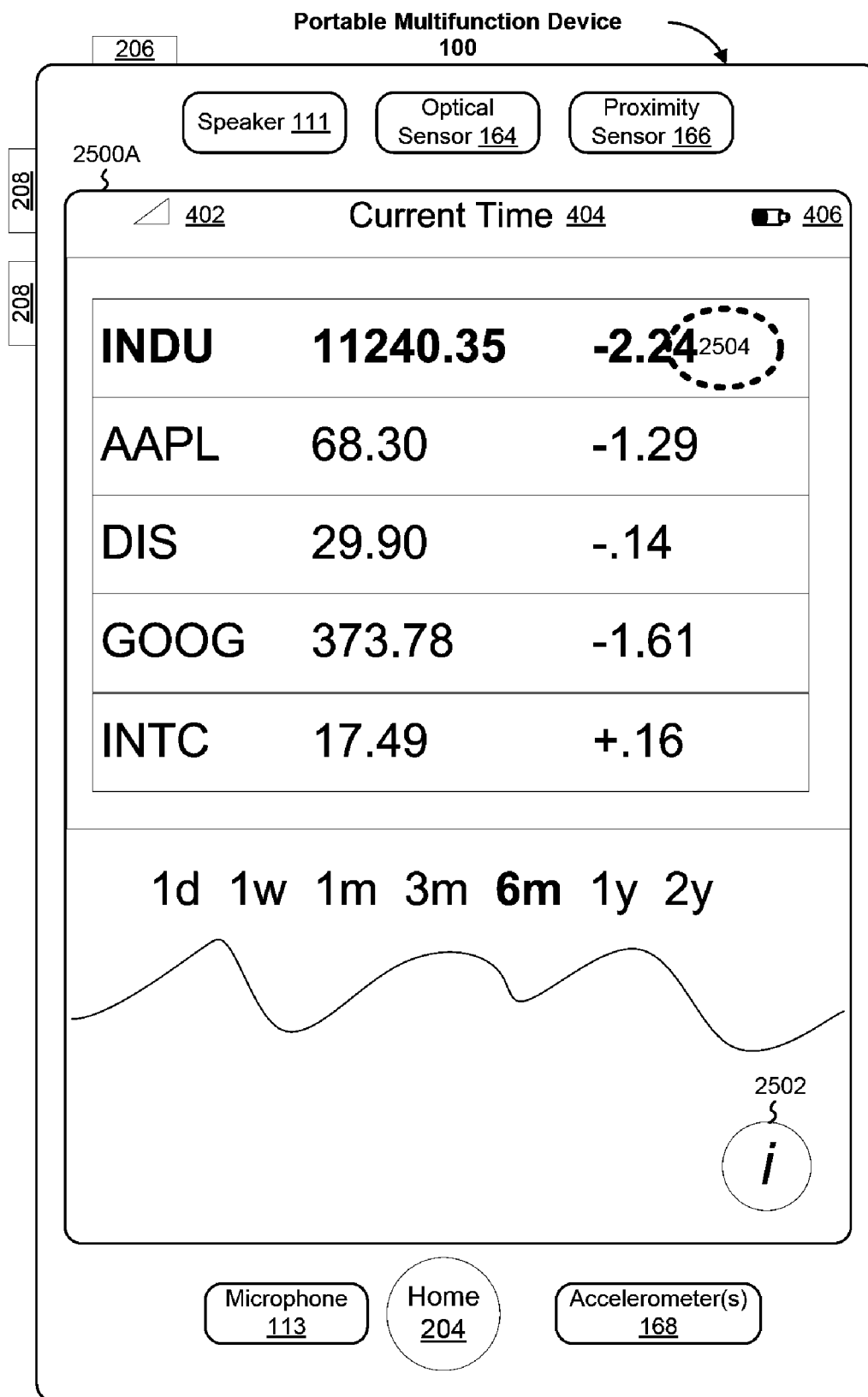


Figure 25A

U.S. Patent

Jan. 20, 2009

Sheet 65 of 293

US 7,479,949 B2

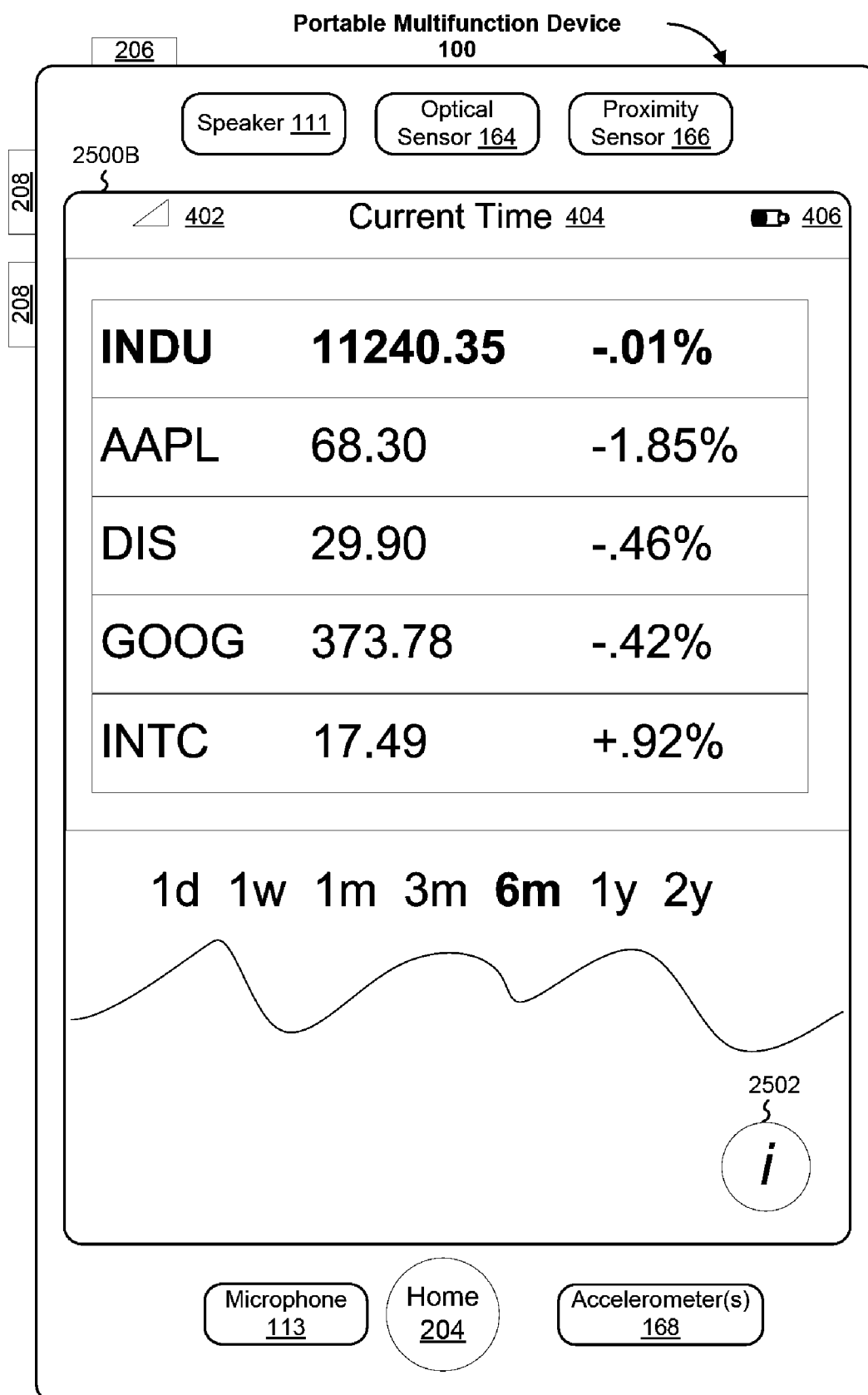


Figure 25B

U.S. Patent

Jan. 20, 2009

Sheet 66 of 293

US 7,479,949 B2

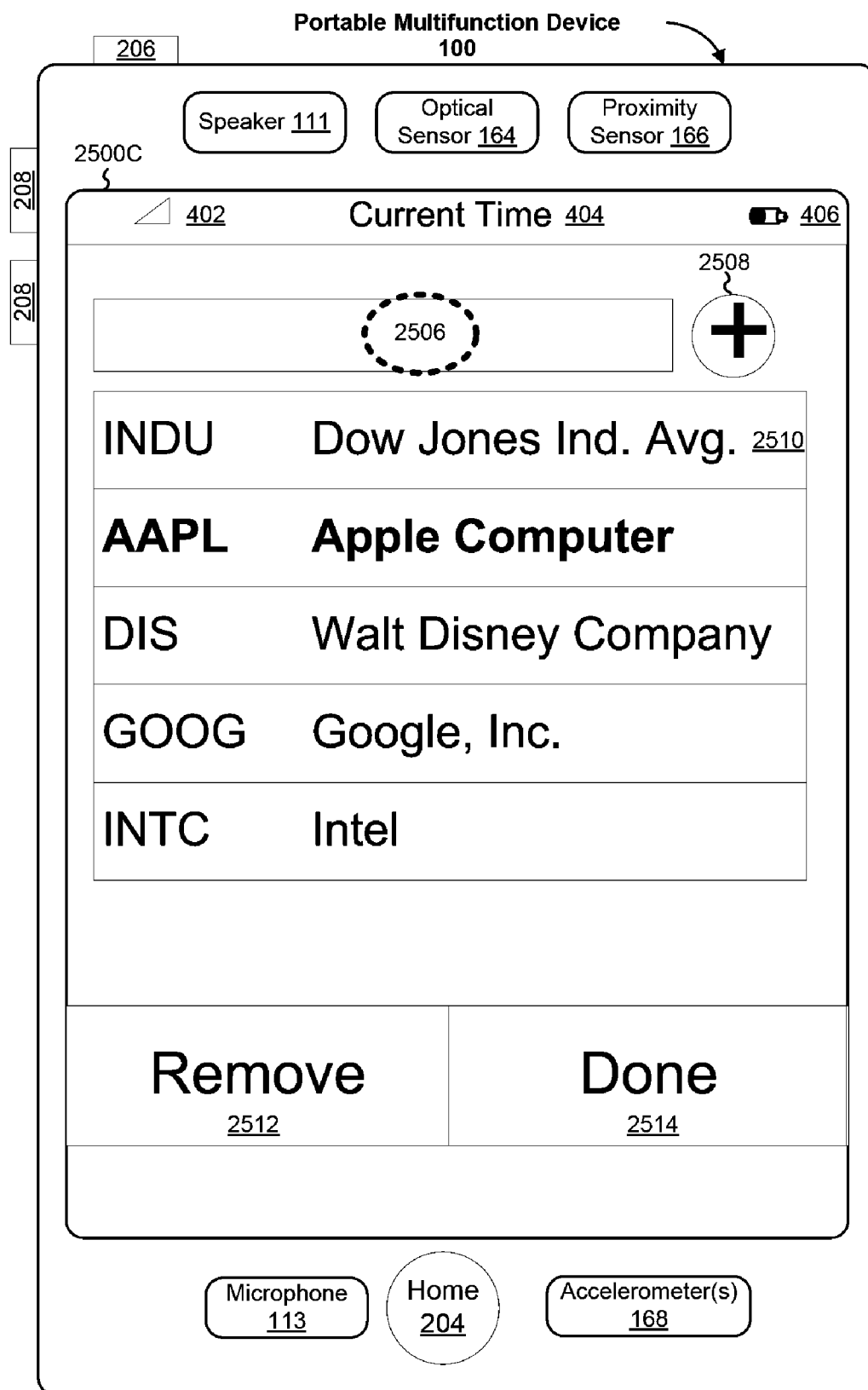


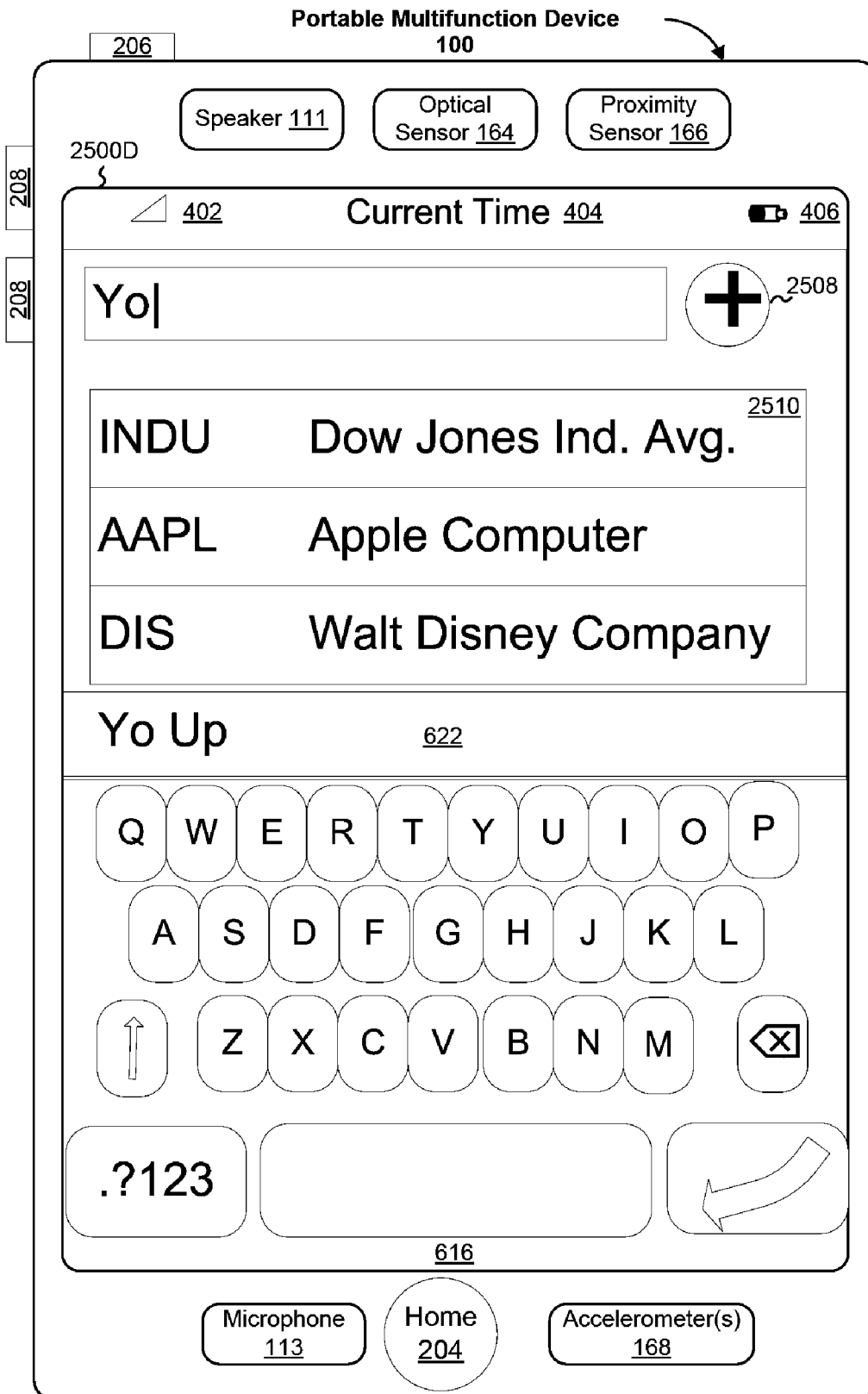
Figure 25C

U.S. Patent

Jan. 20, 2009

Sheet 67 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 68 of 293

US 7,479,949 B2

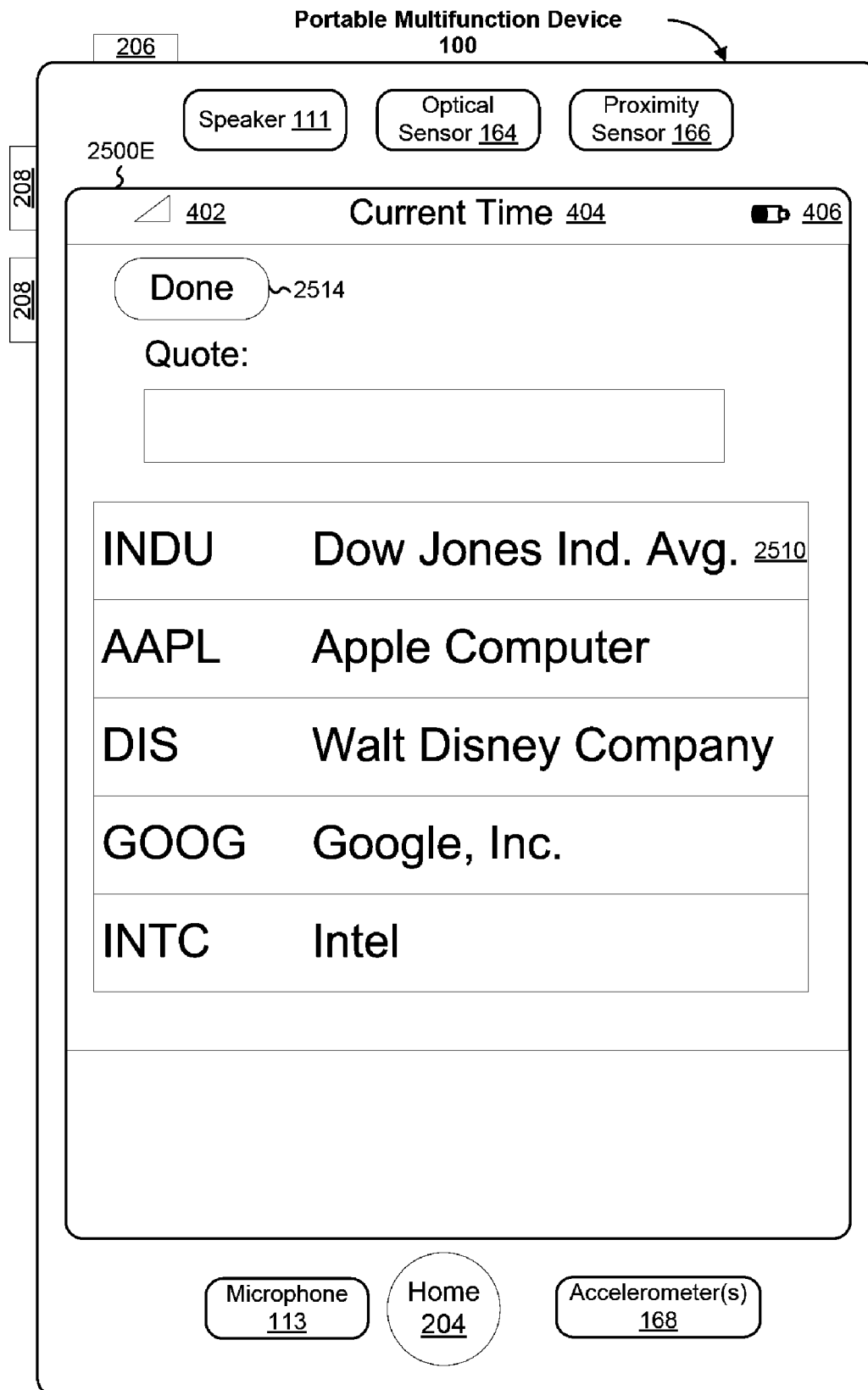


Figure 25E

U.S. Patent

Jan. 20, 2009

Sheet 69 of 293

US 7,479,949 B2

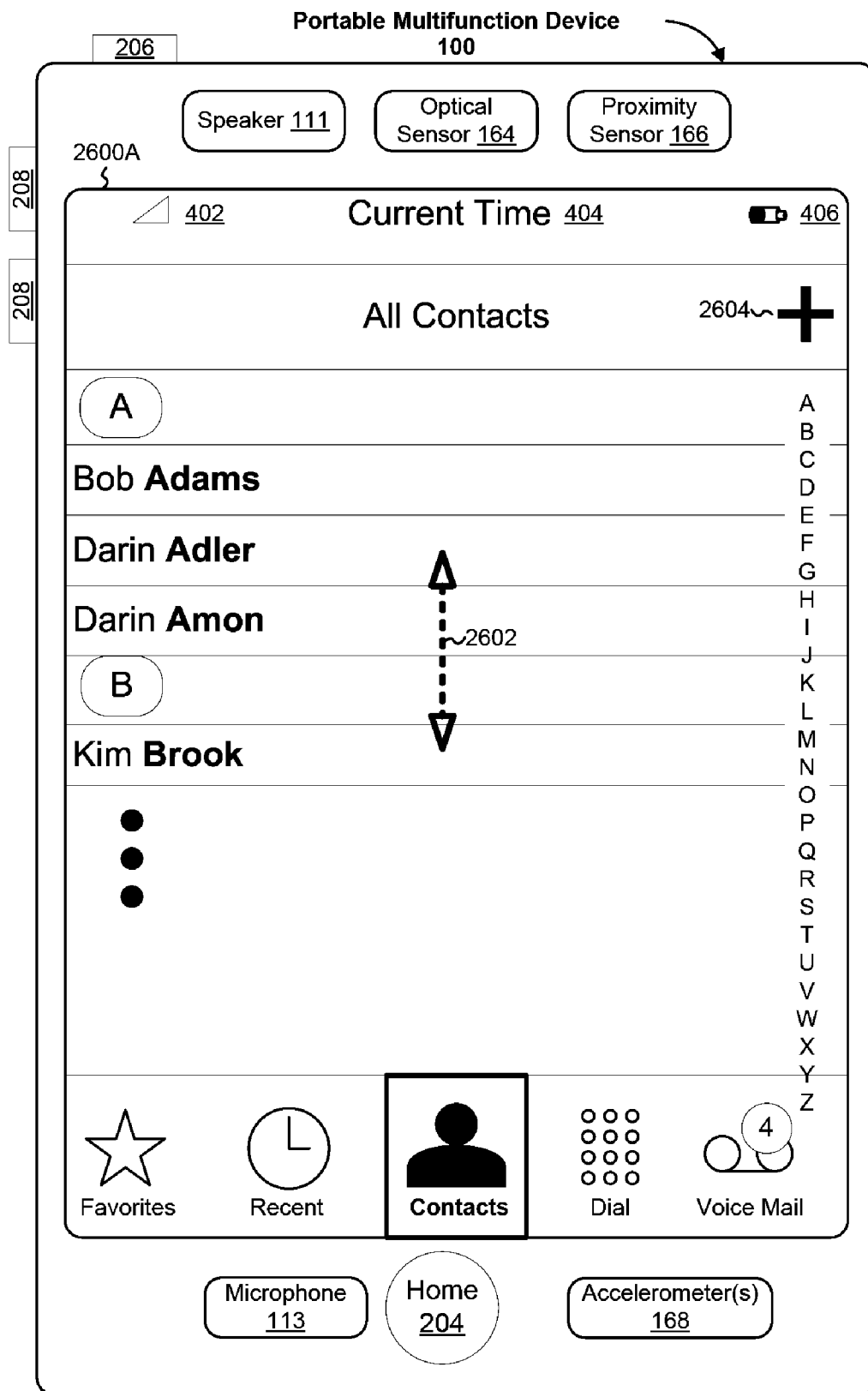


Figure 26A

U.S. Patent

Jan. 20, 2009

Sheet 70 of 293

US 7,479,949 B2

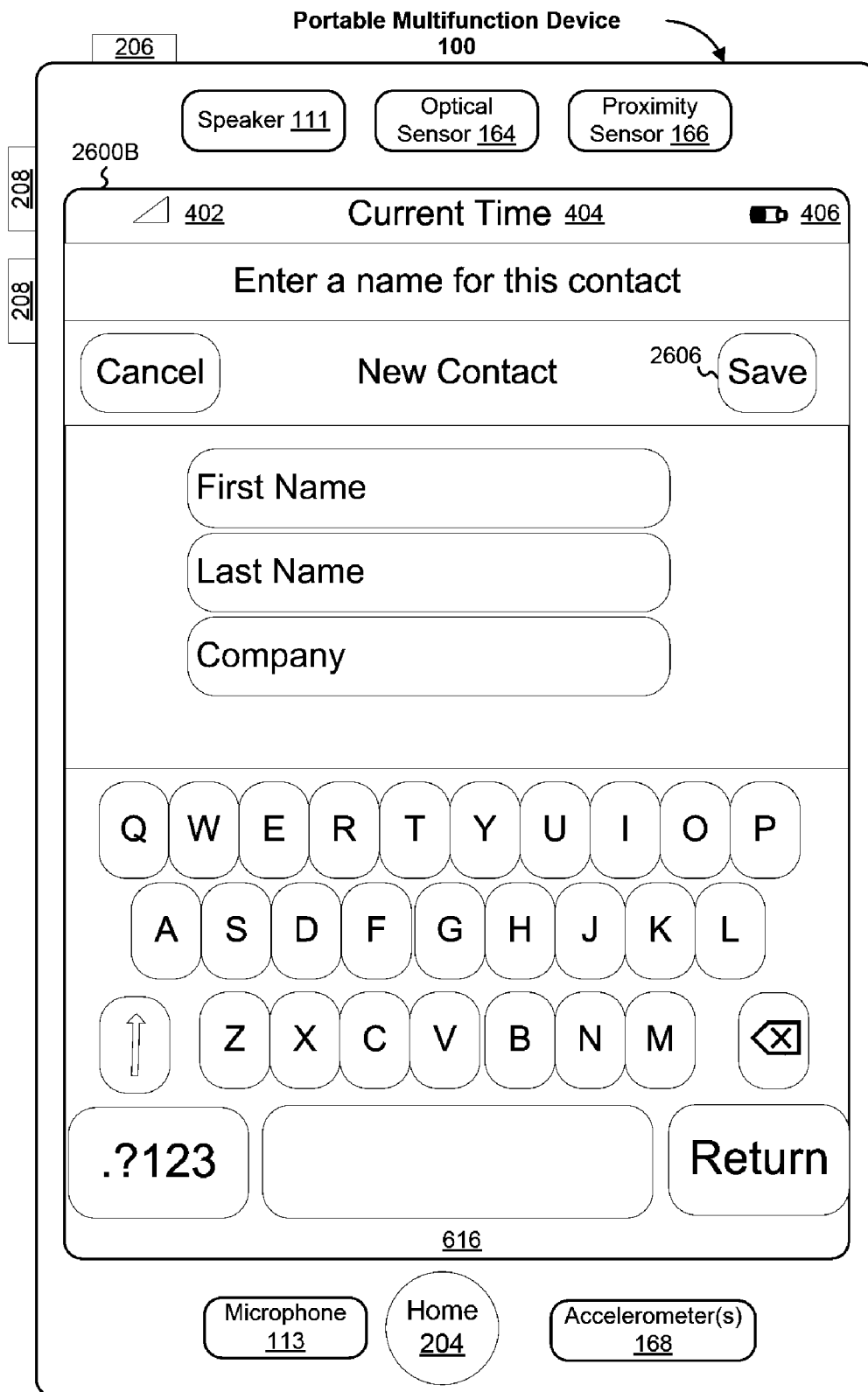


Figure 26B

U.S. Patent

Jan. 20, 2009

Sheet 71 of 293

US 7,479,949 B2

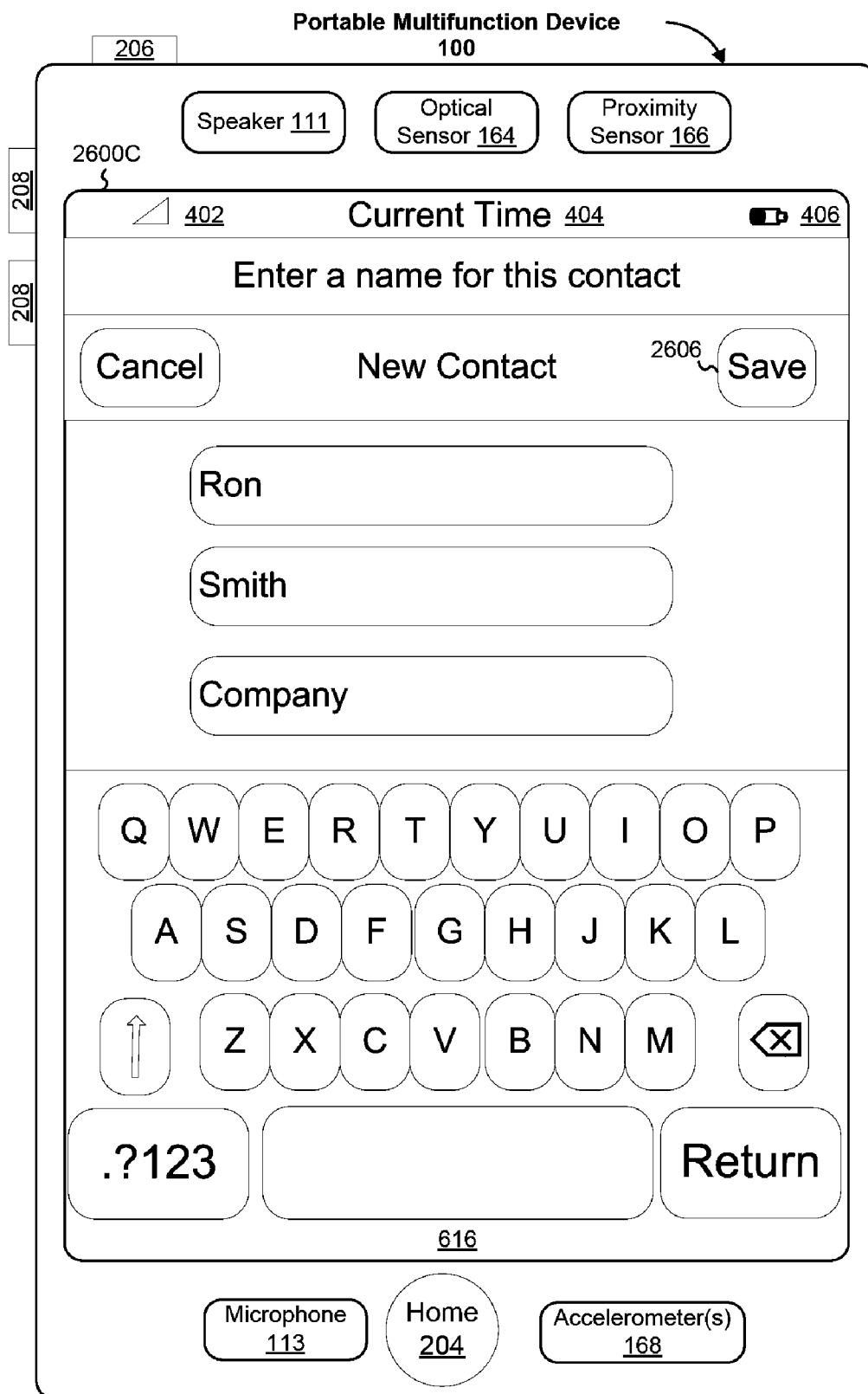


Figure 26C



Figure 26D

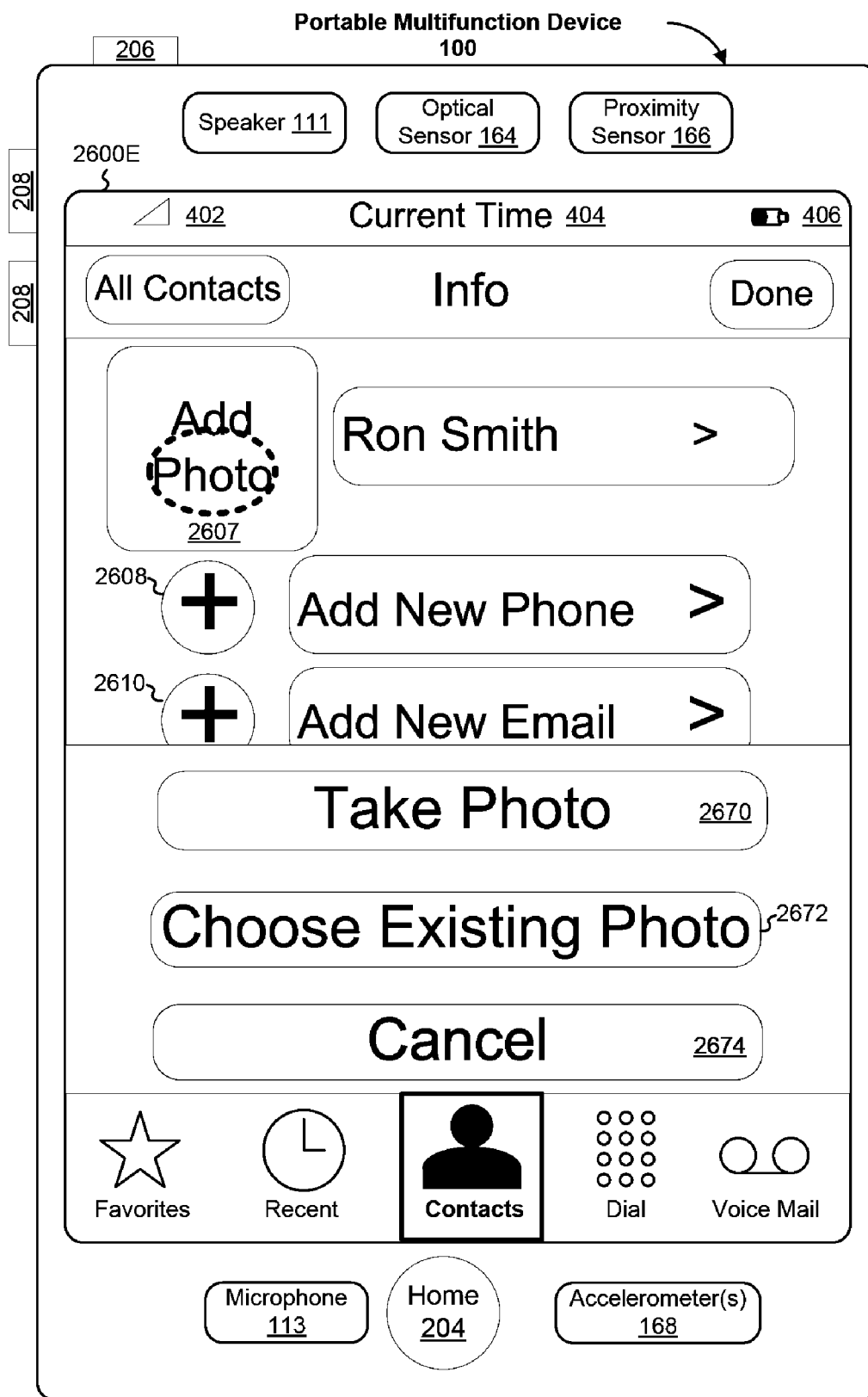


Figure 26E

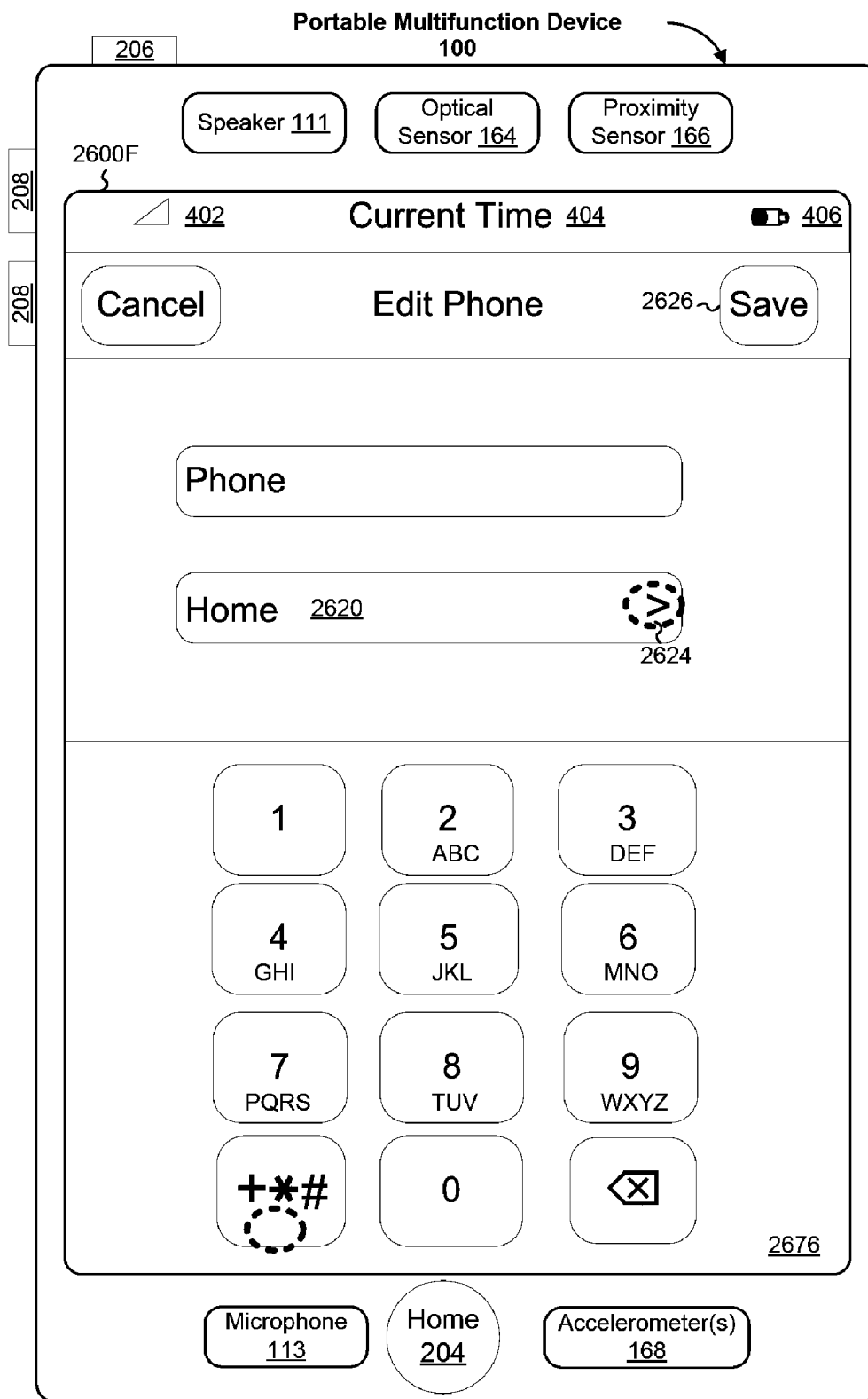


Figure 26F

U.S. Patent

Jan. 20, 2009

Sheet 75 of 293

US 7,479,949 B2

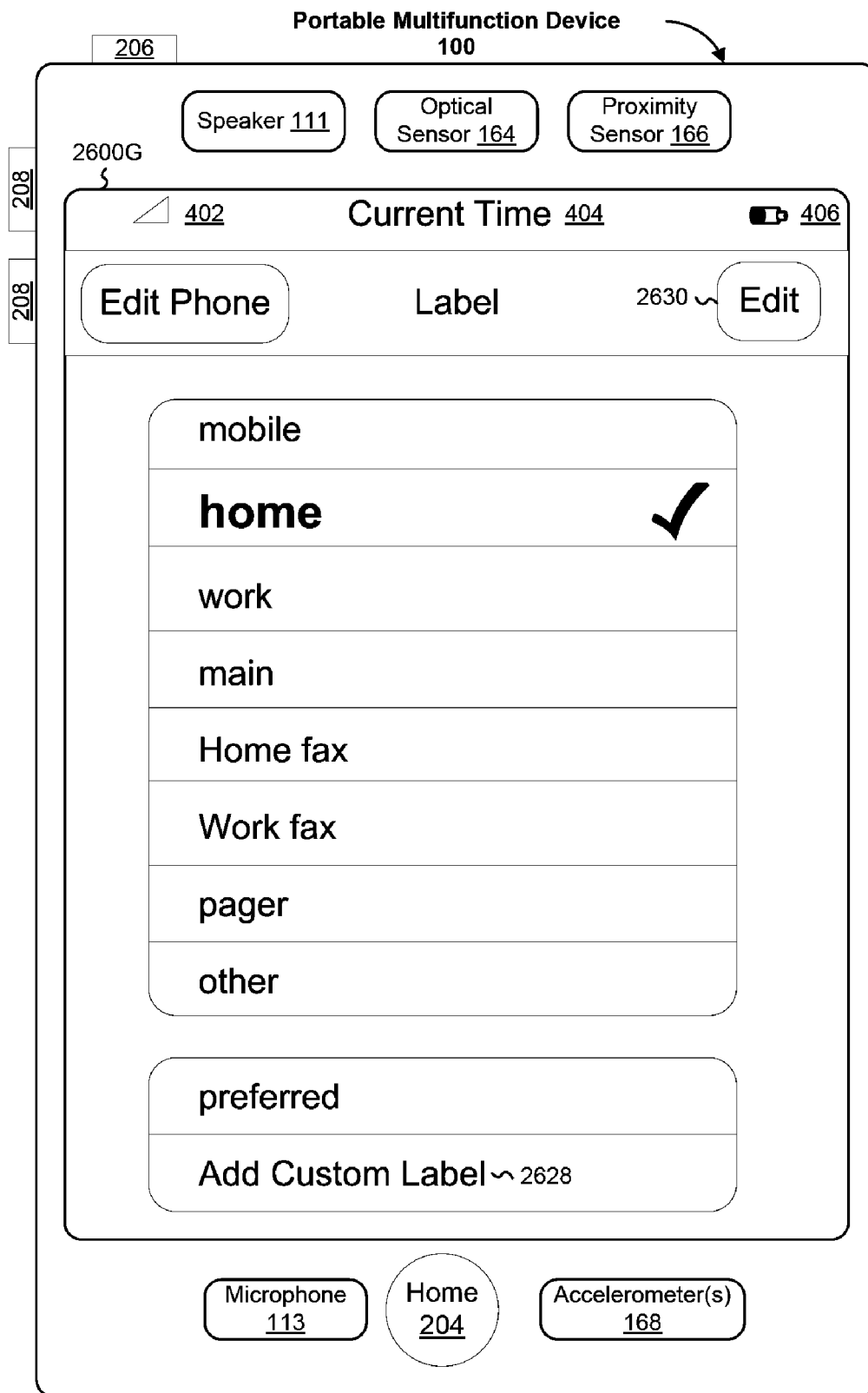


Figure 26G

U.S. Patent

Jan. 20, 2009

Sheet 76 of 293

US 7,479,949 B2

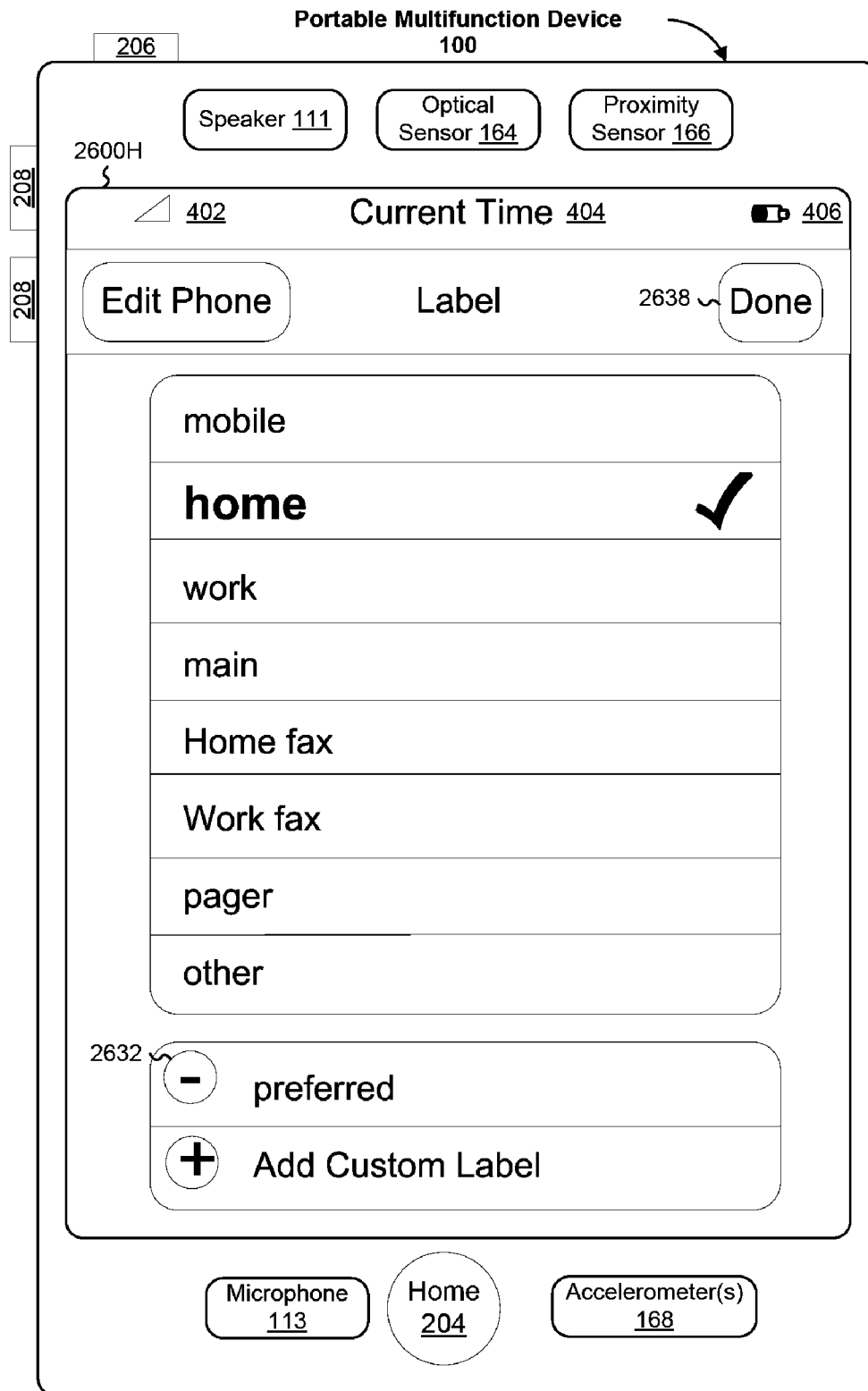


Figure 26H

U.S. Patent

Jan. 20, 2009

Sheet 77 of 293

US 7,479,949 B2

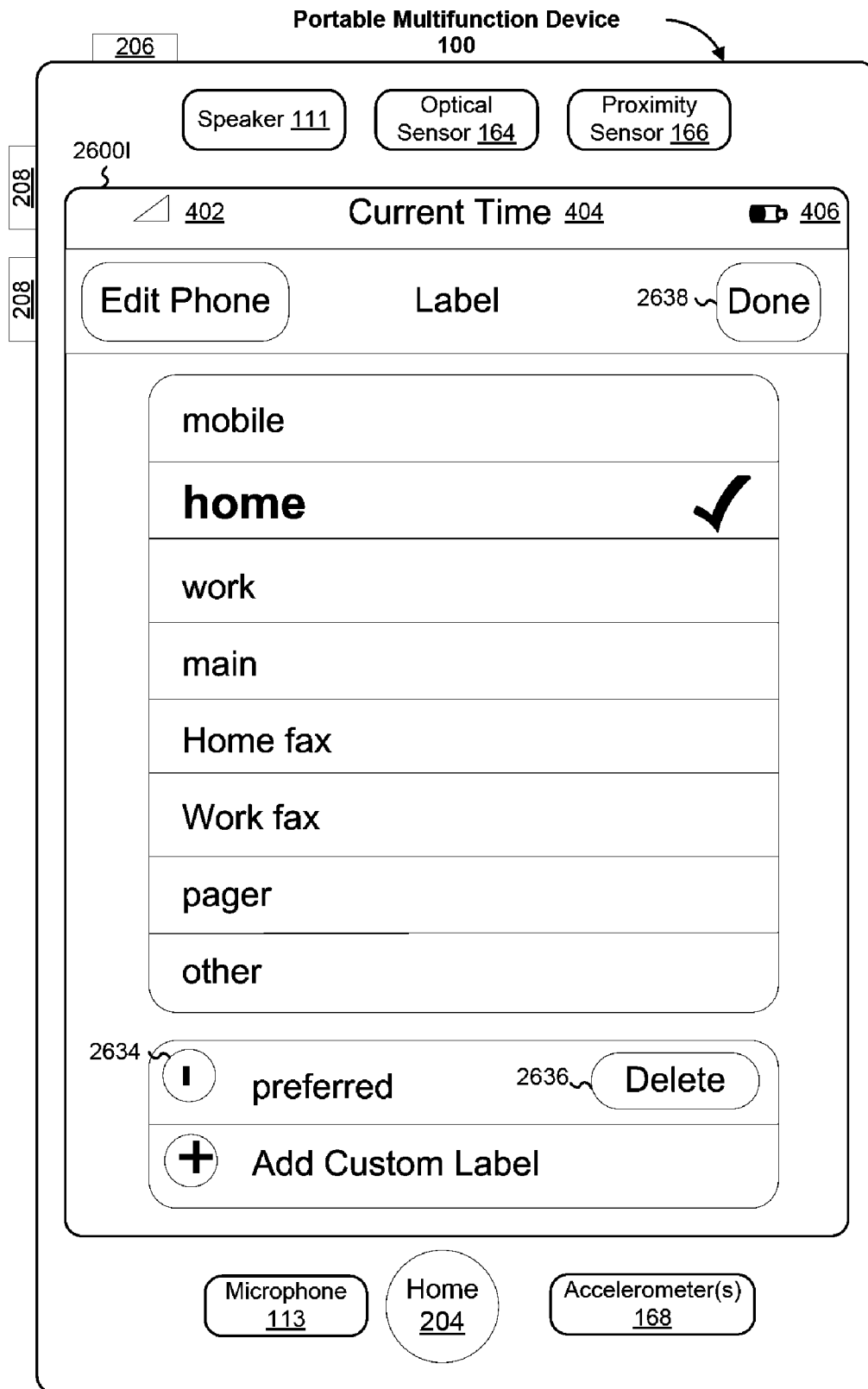


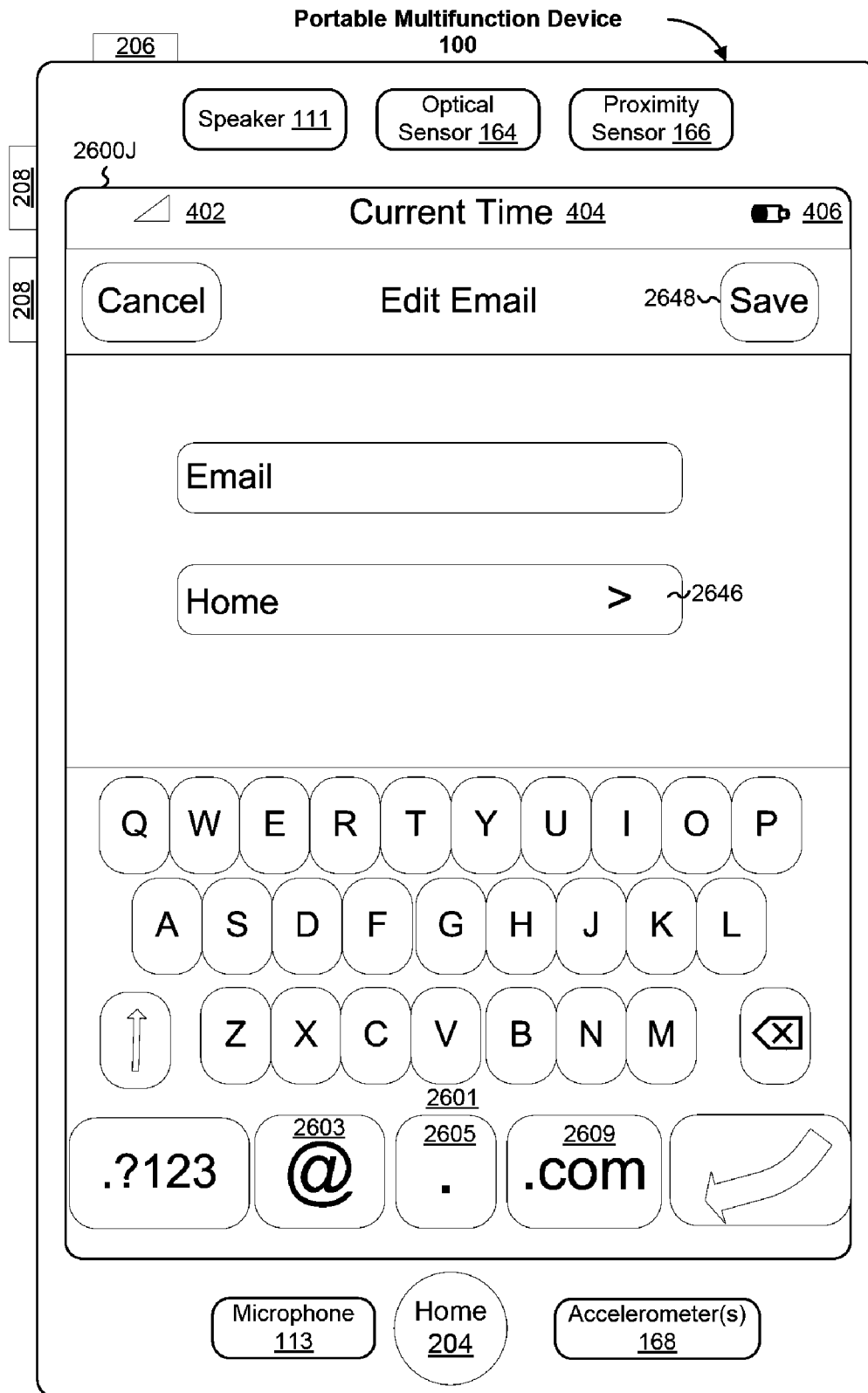
Figure 26I

U.S. Patent

Jan. 20, 2009

Sheet 78 of 293

US 7,479,949 B2



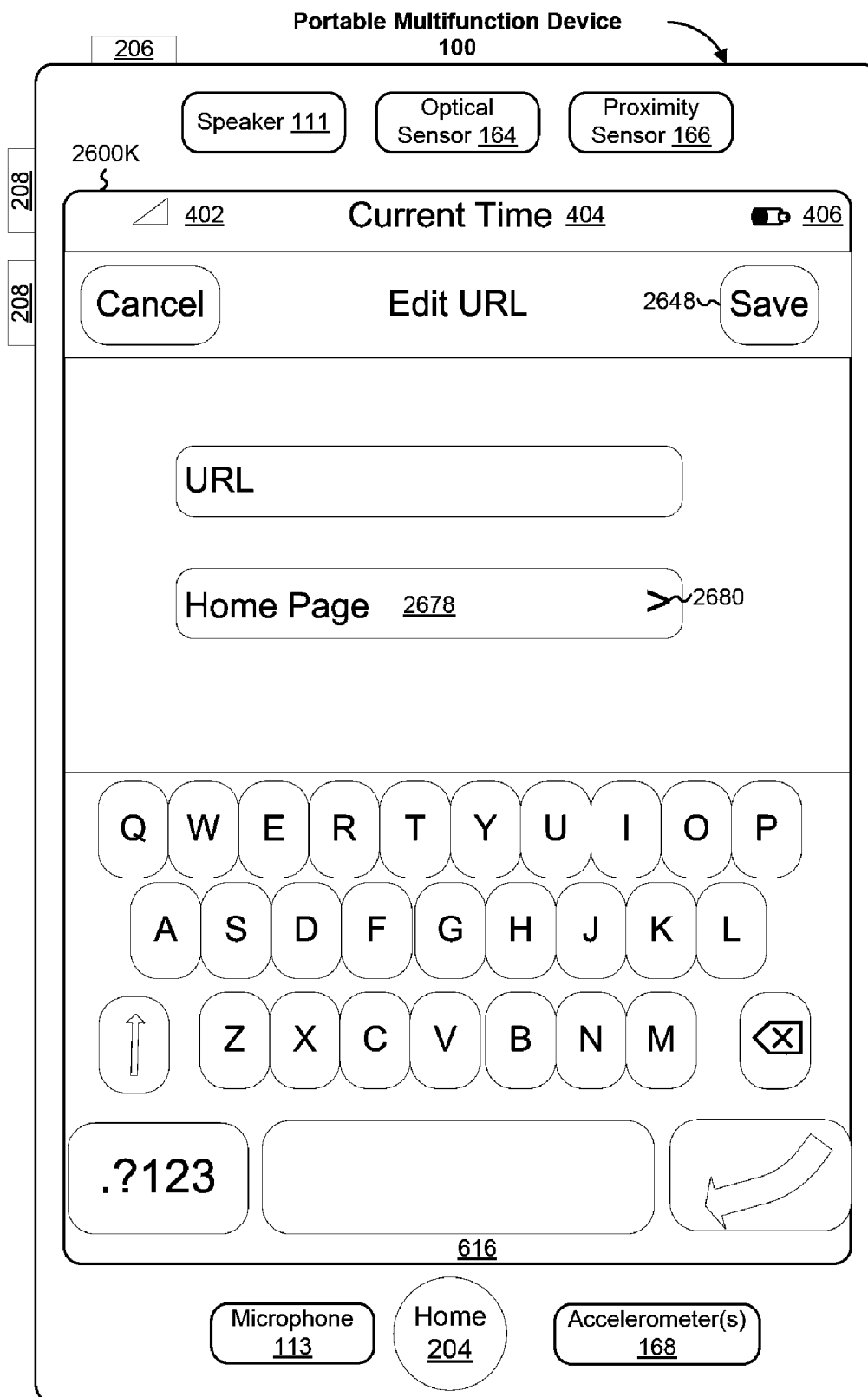


Figure 26K

U.S. Patent

Jan. 20, 2009

Sheet 80 of 293

US 7,479,949 B2

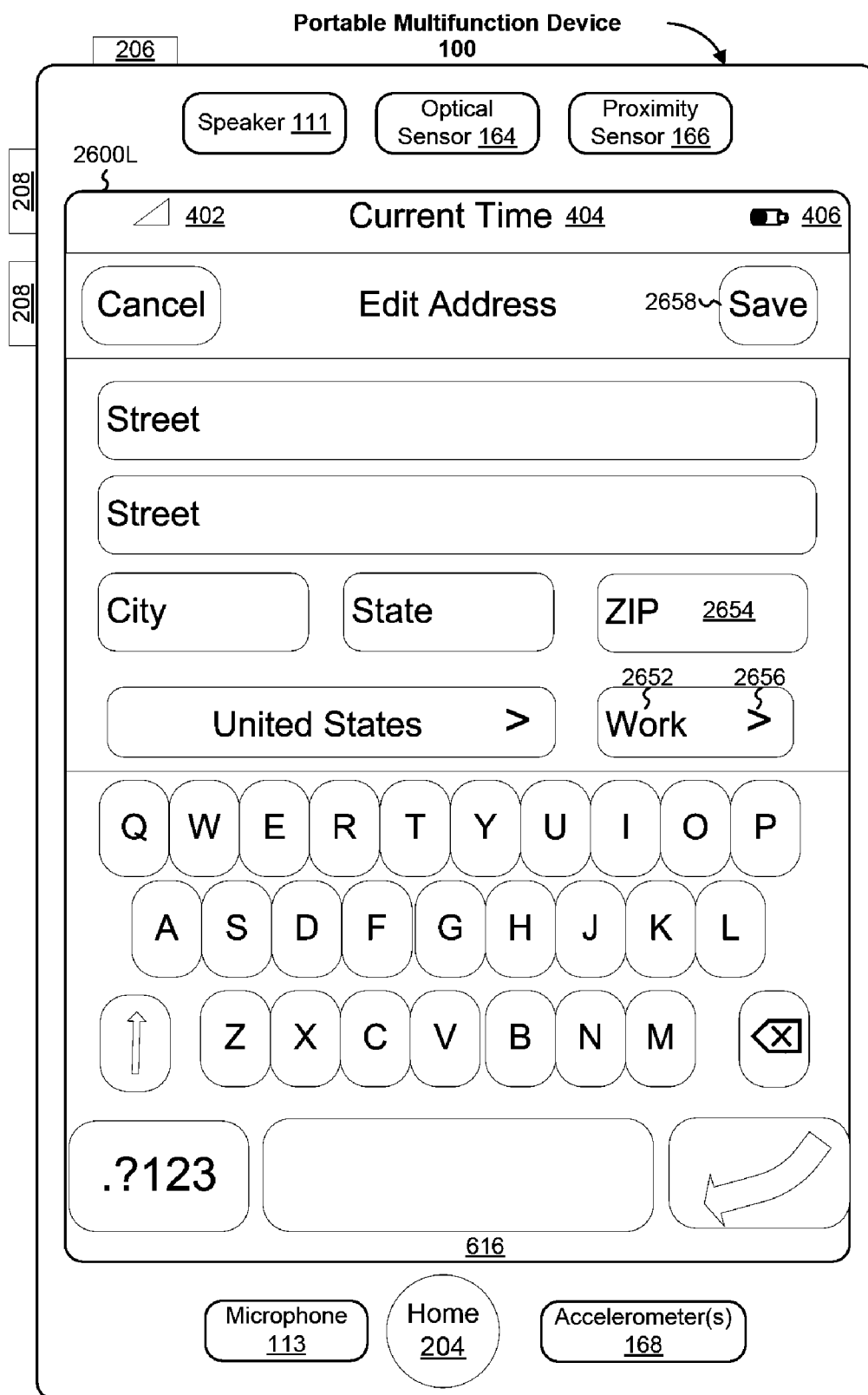


Figure 26L

U.S. Patent

Jan. 20, 2009

Sheet 81 of 293

US 7,479,949 B2

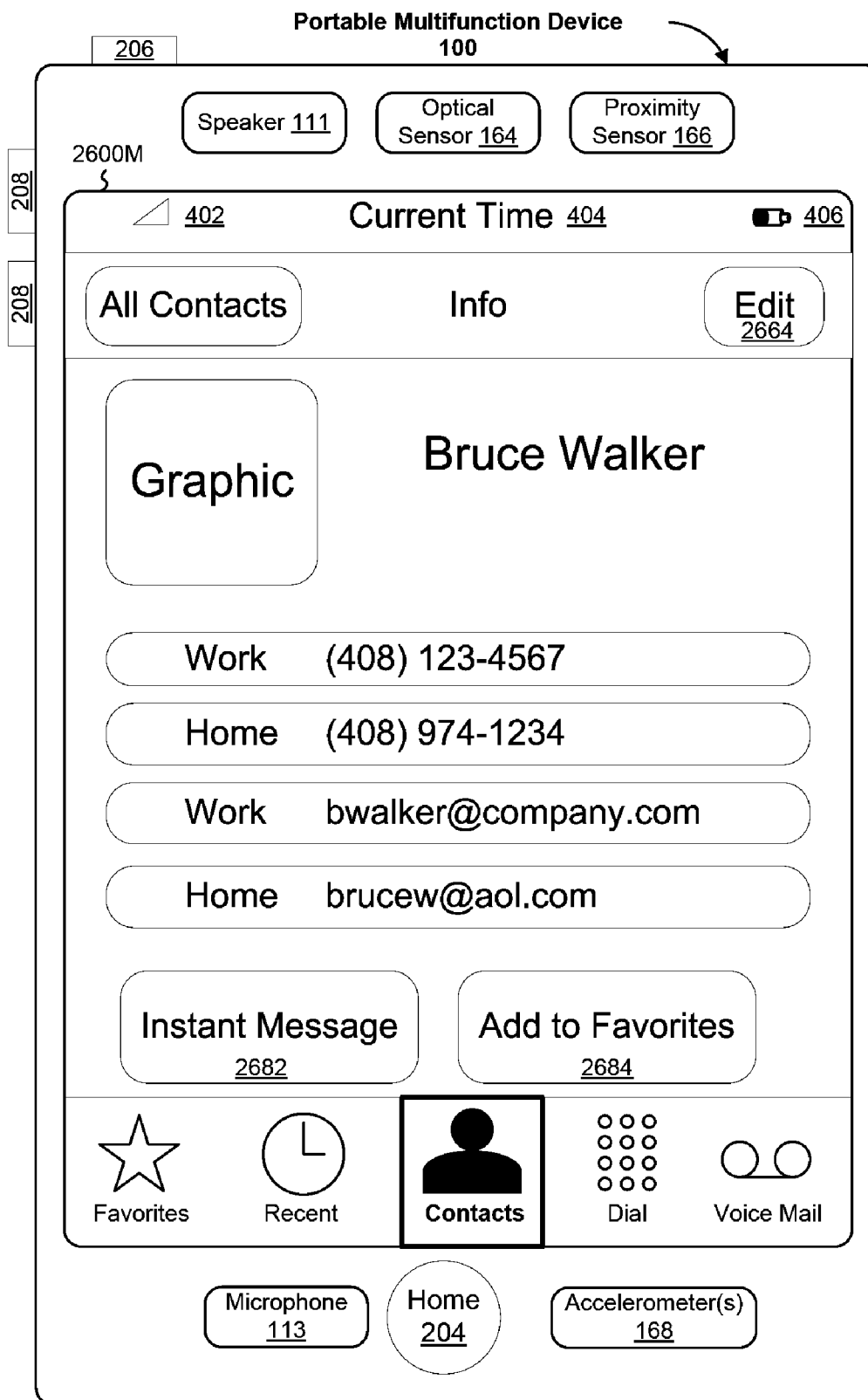


Figure 26M

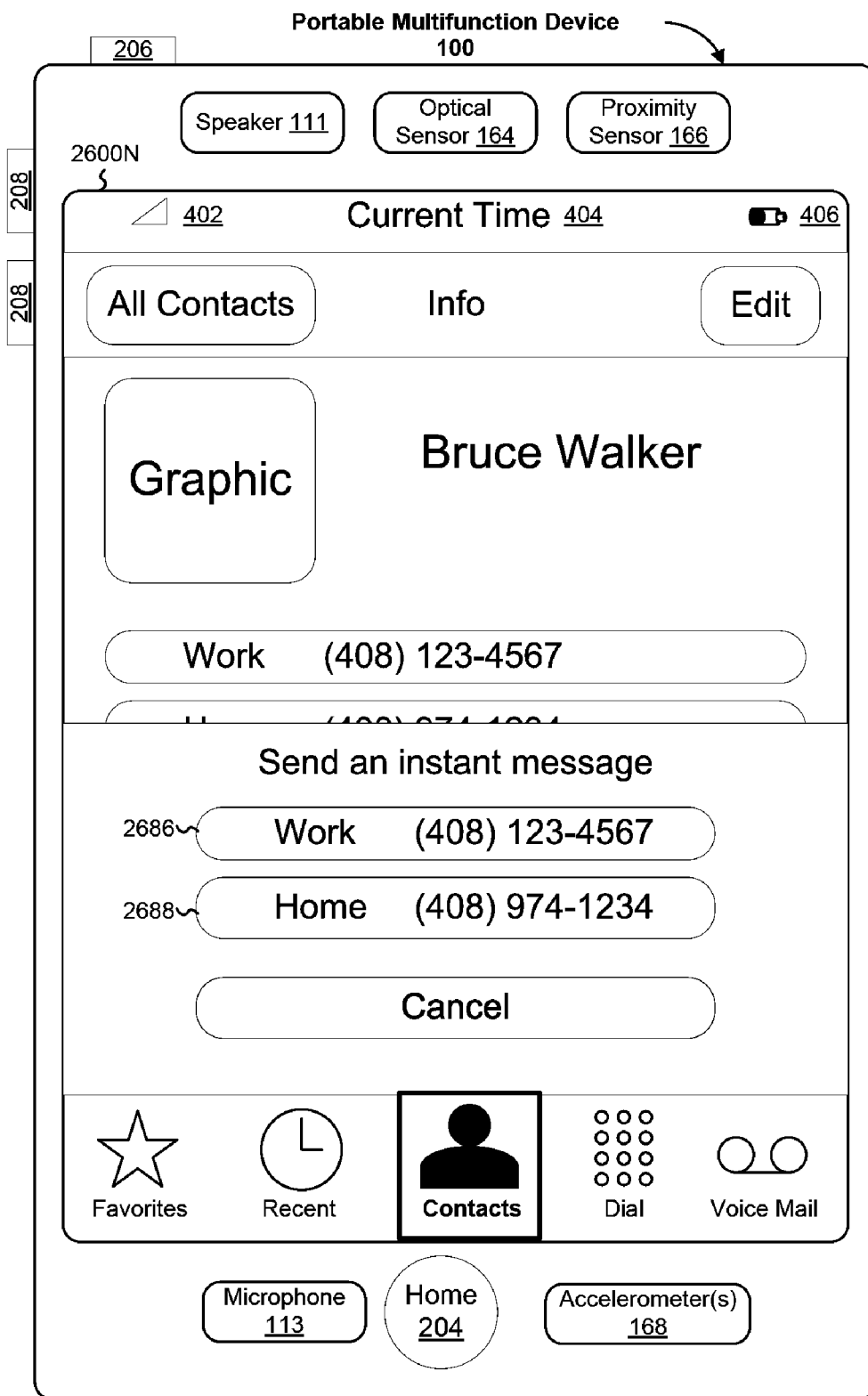


Figure 26N

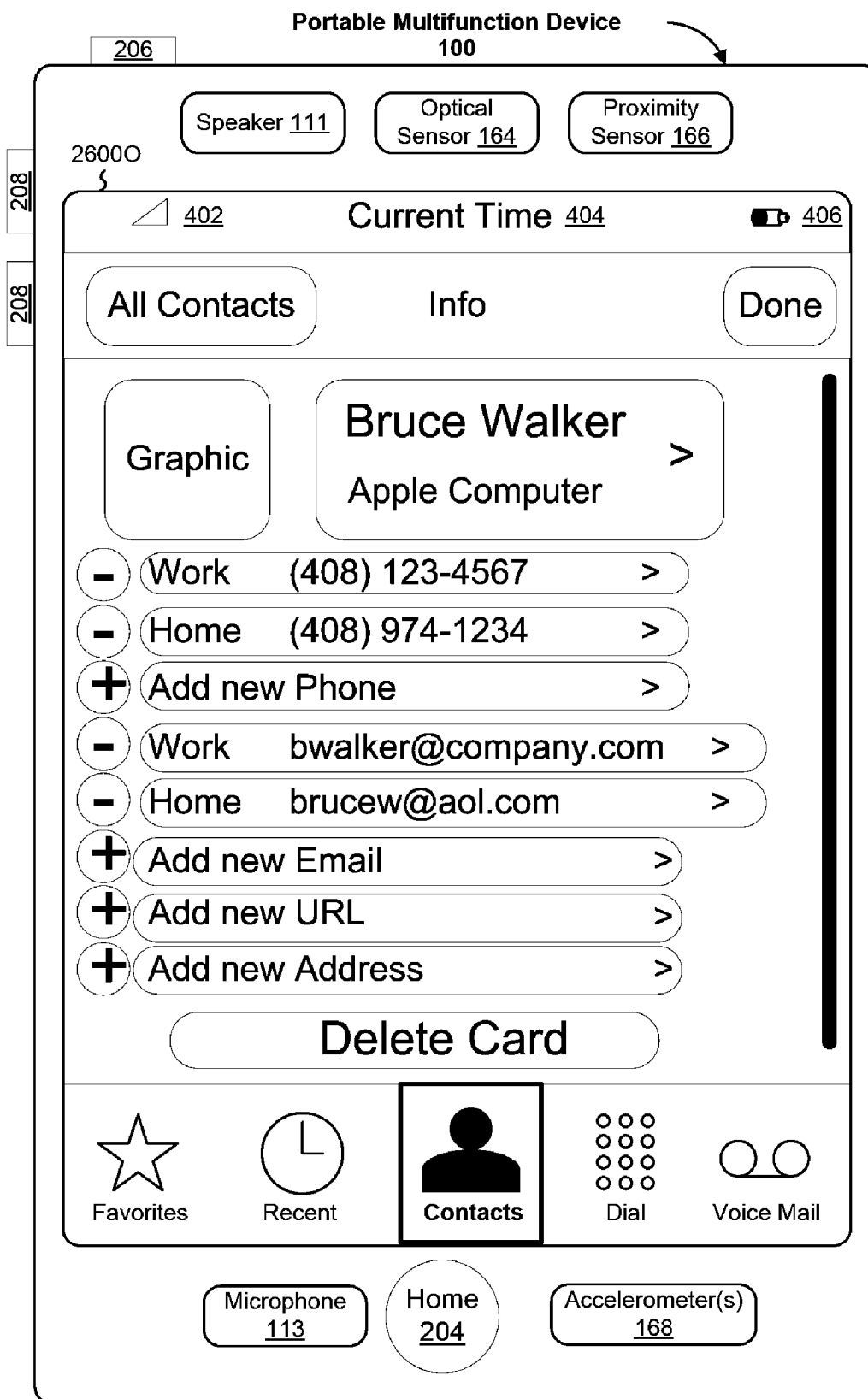


Figure 260

U.S. Patent

Jan. 20, 2009

Sheet 84 of 293

US 7,479,949 B2

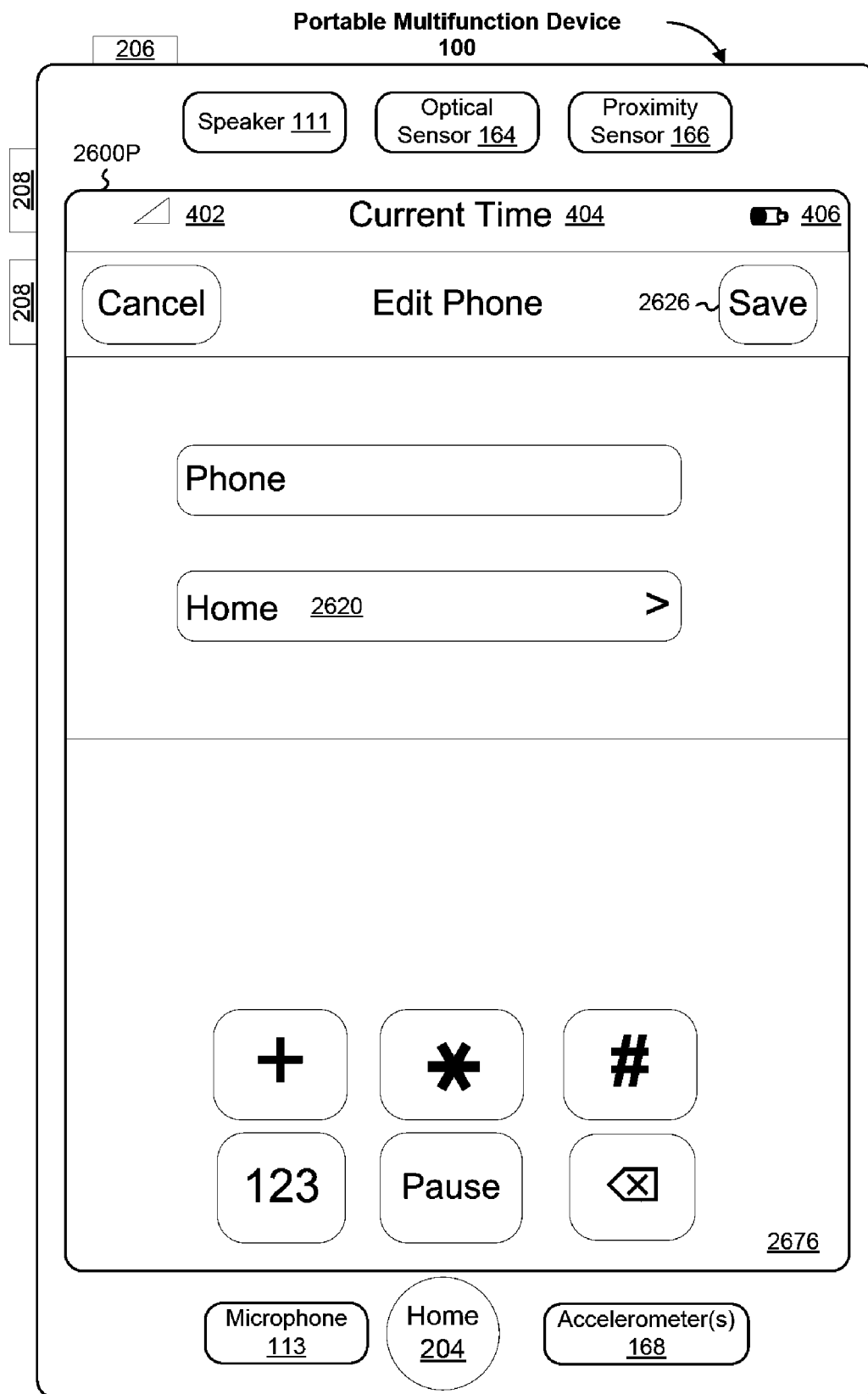


Figure 26P

U.S. Patent

Jan. 20, 2009

Sheet 85 of 293

US 7,479,949 B2

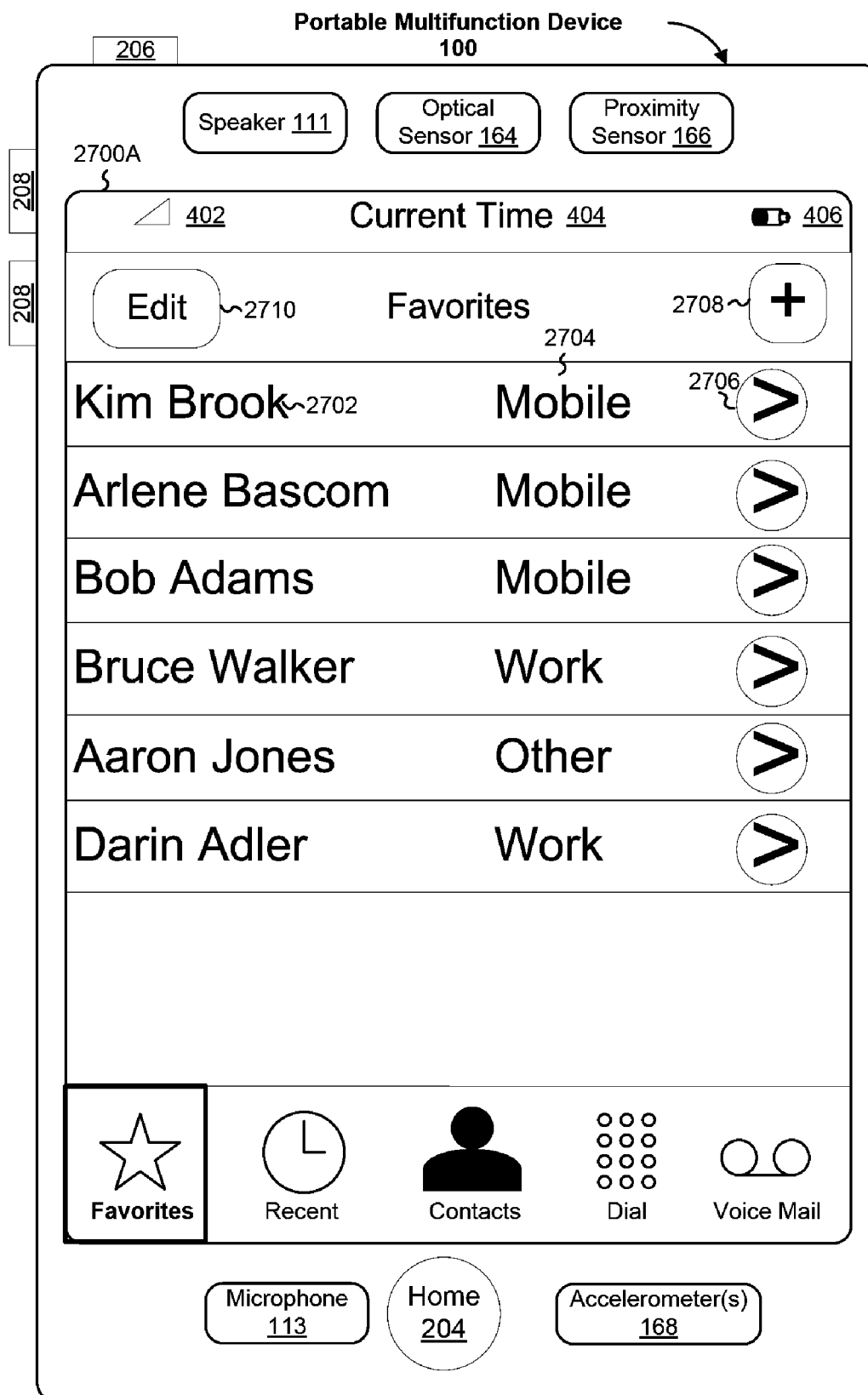


Figure 27A

U.S. Patent

Jan. 20, 2009

Sheet 86 of 293

US 7,479,949 B2

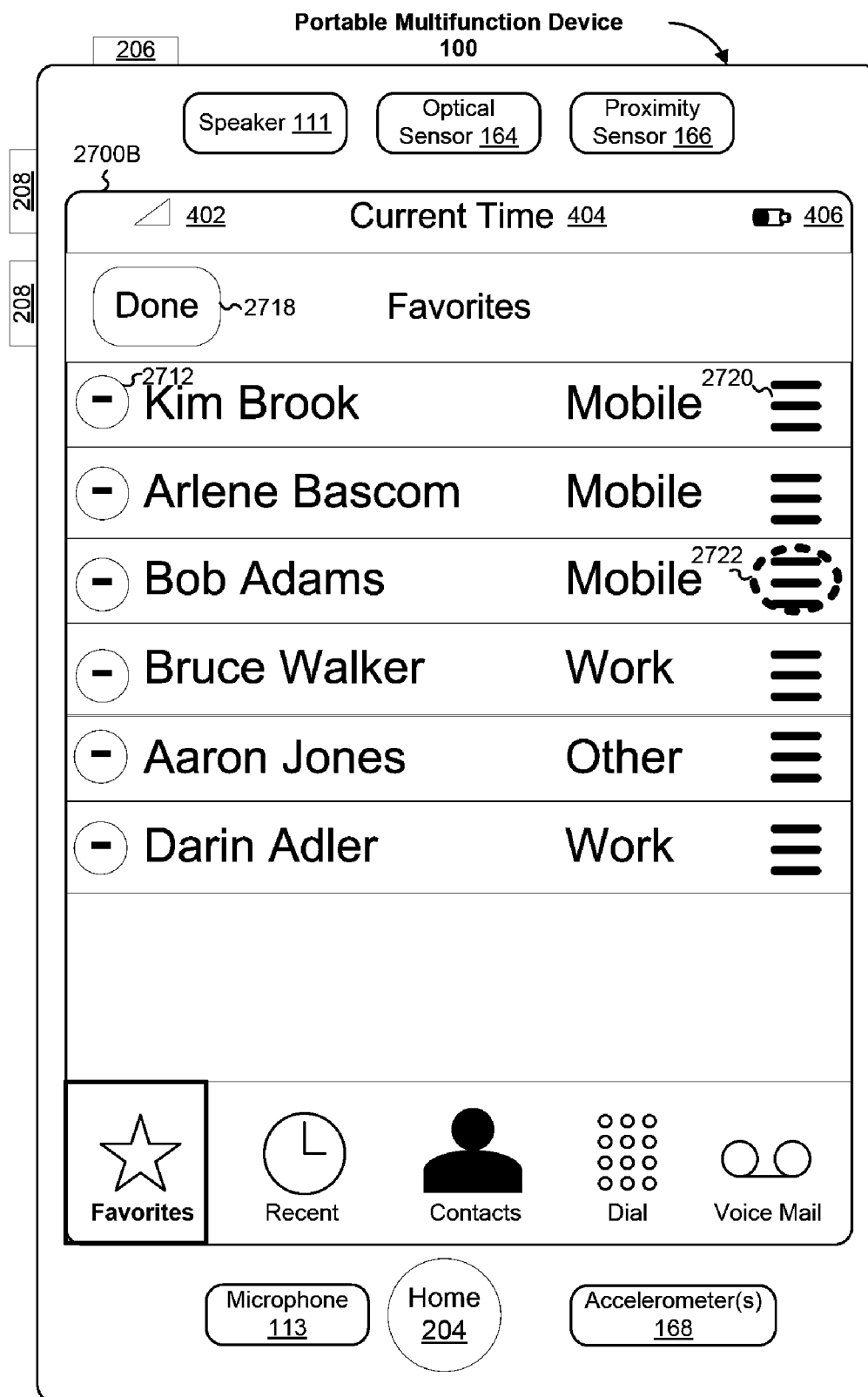


Figure 27B

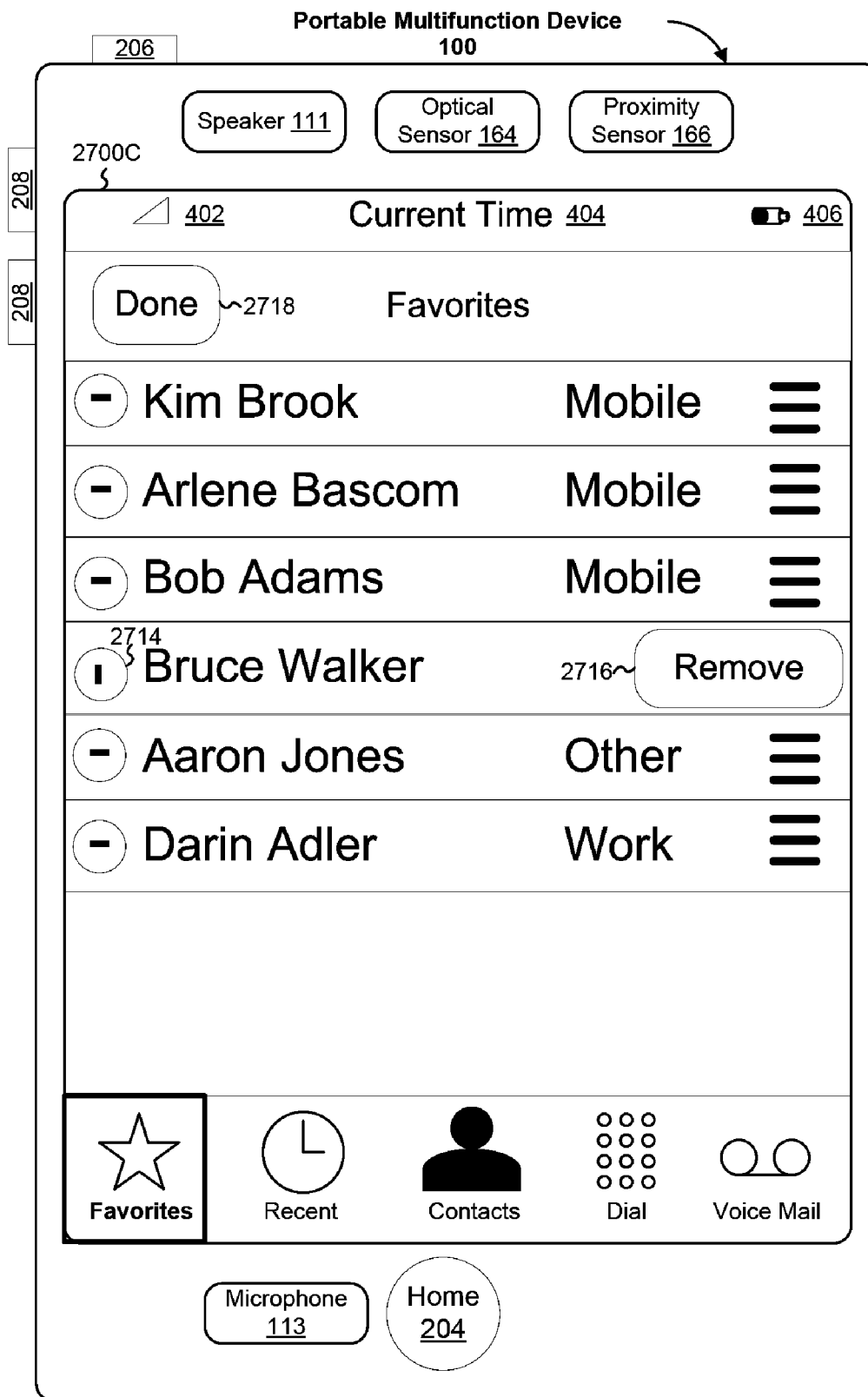


Figure 27C

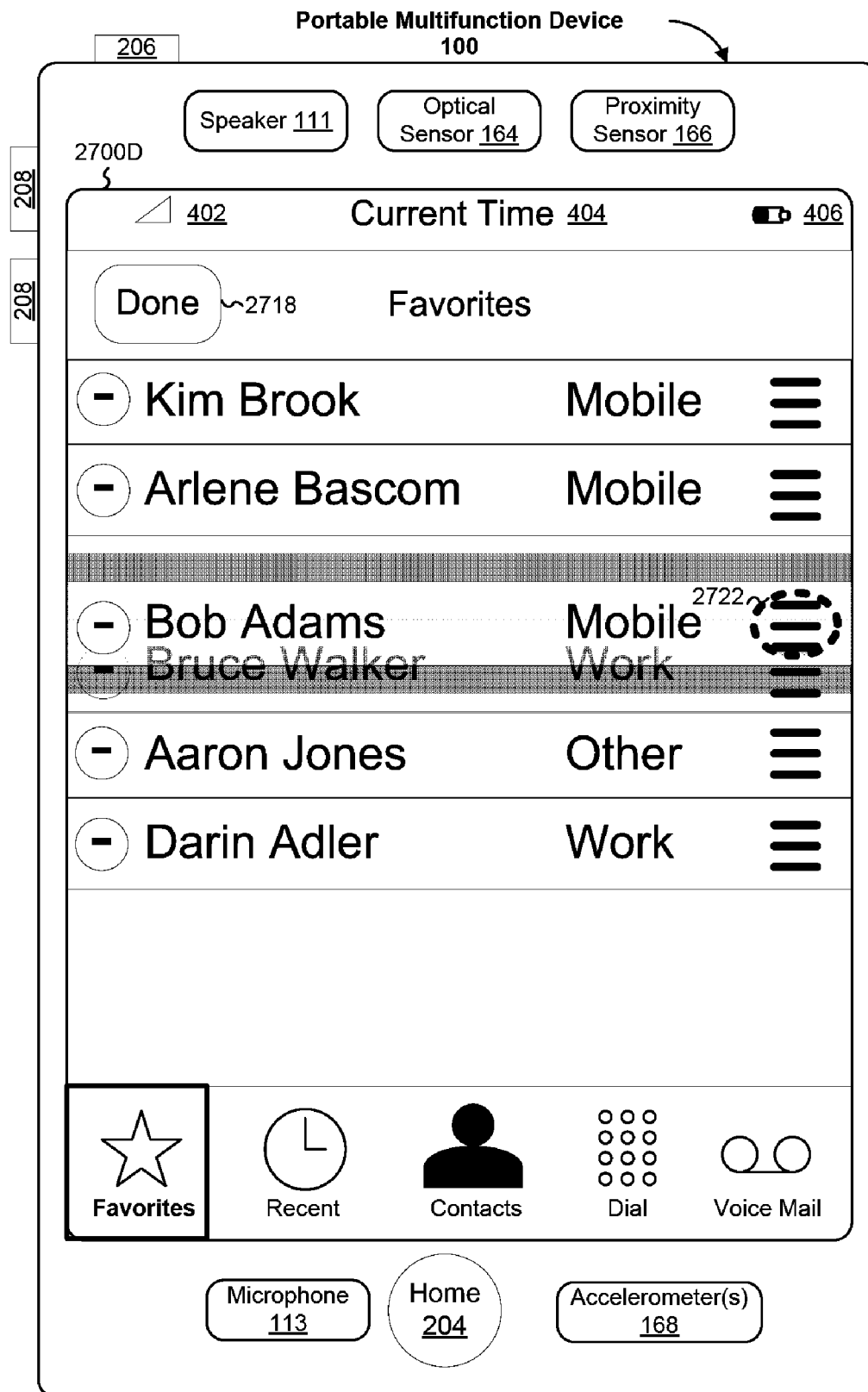


Figure 27D

U.S. Patent

Jan. 20, 2009

Sheet 89 of 293

US 7,479,949 B2

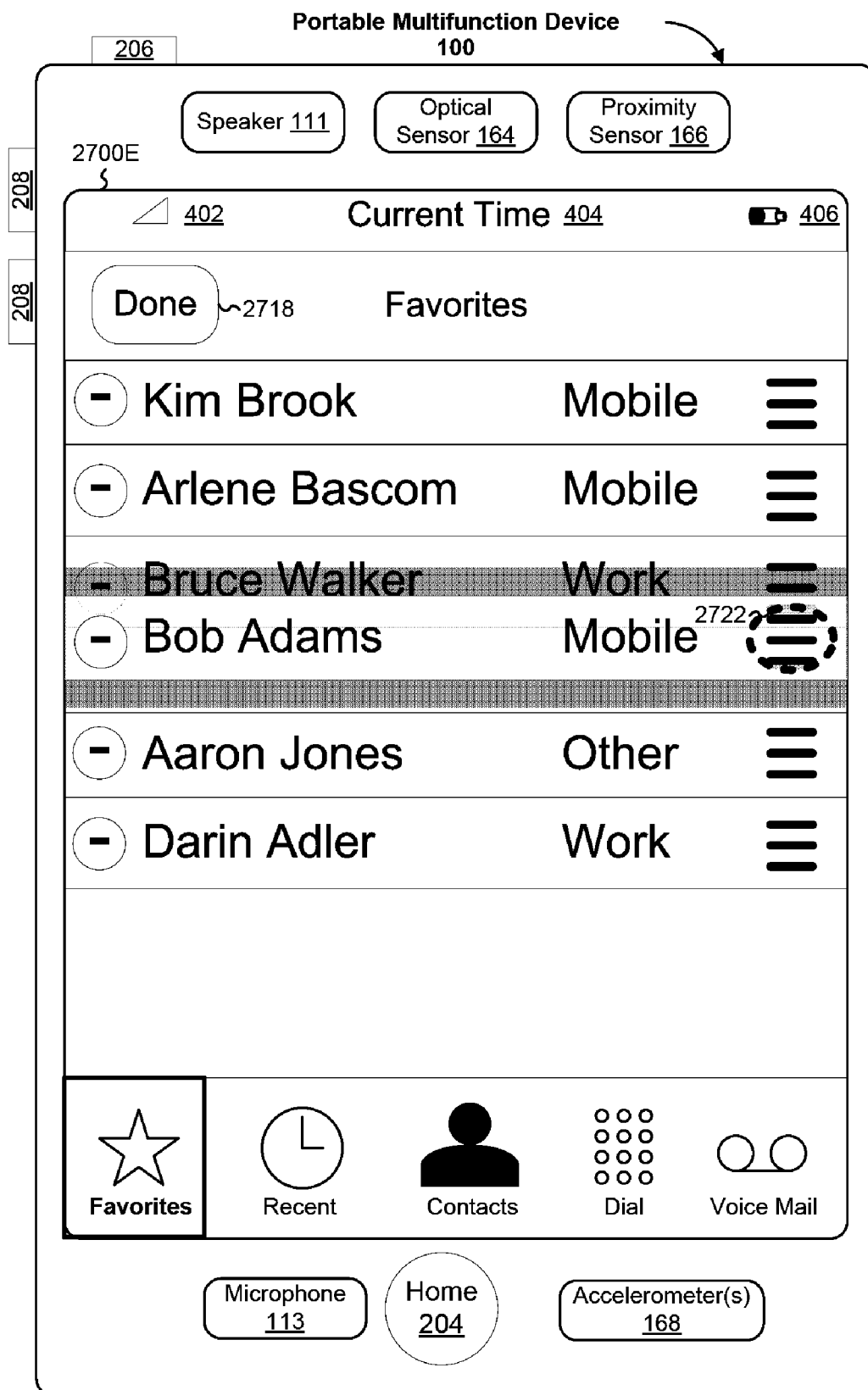


Figure 27E

U.S. Patent

Jan. 20, 2009

Sheet 90 of 293

US 7,479,949 B2

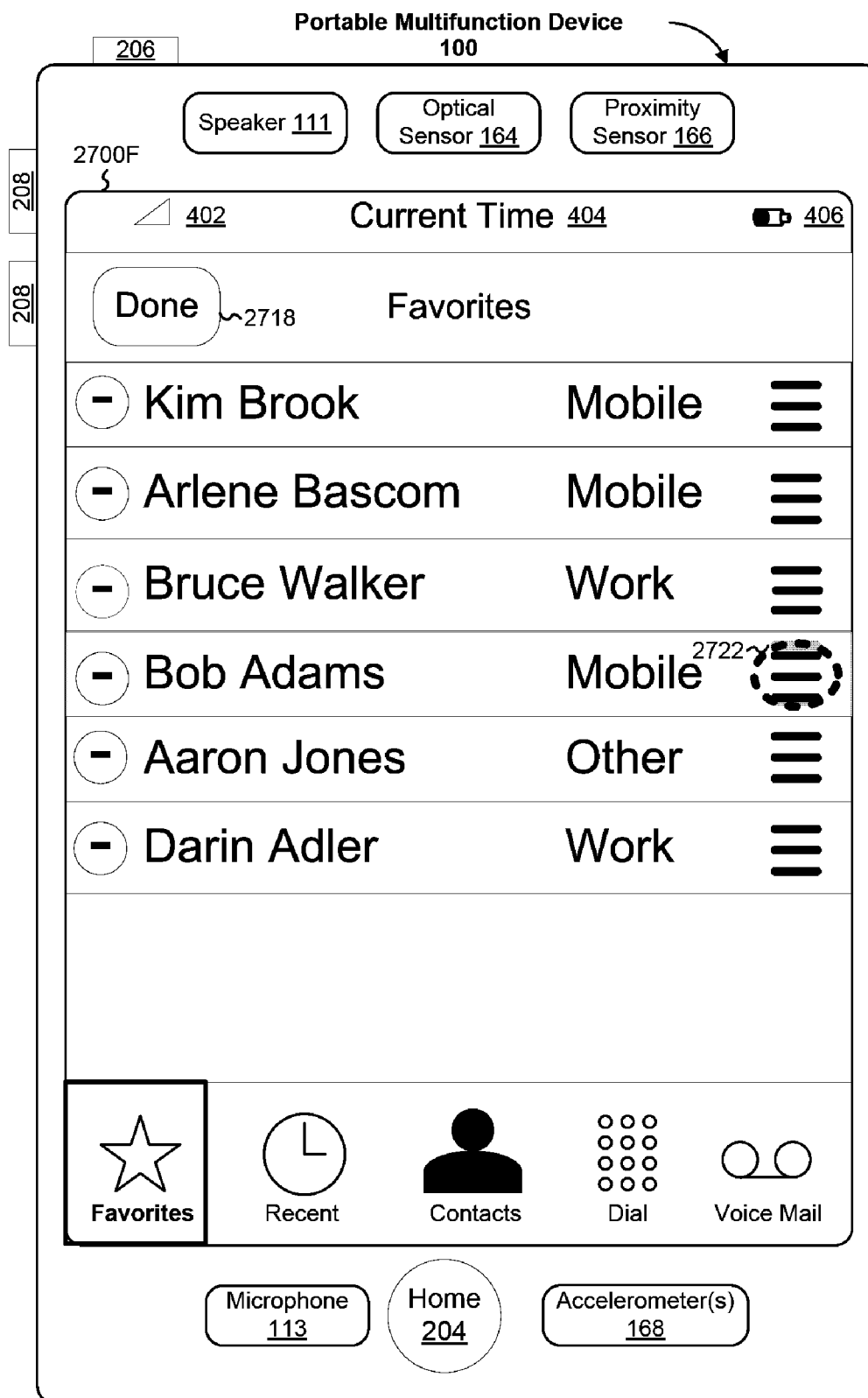


Figure 27F

U.S. Patent

Jan. 20, 2009

Sheet 91 of 293

US 7,479,949 B2

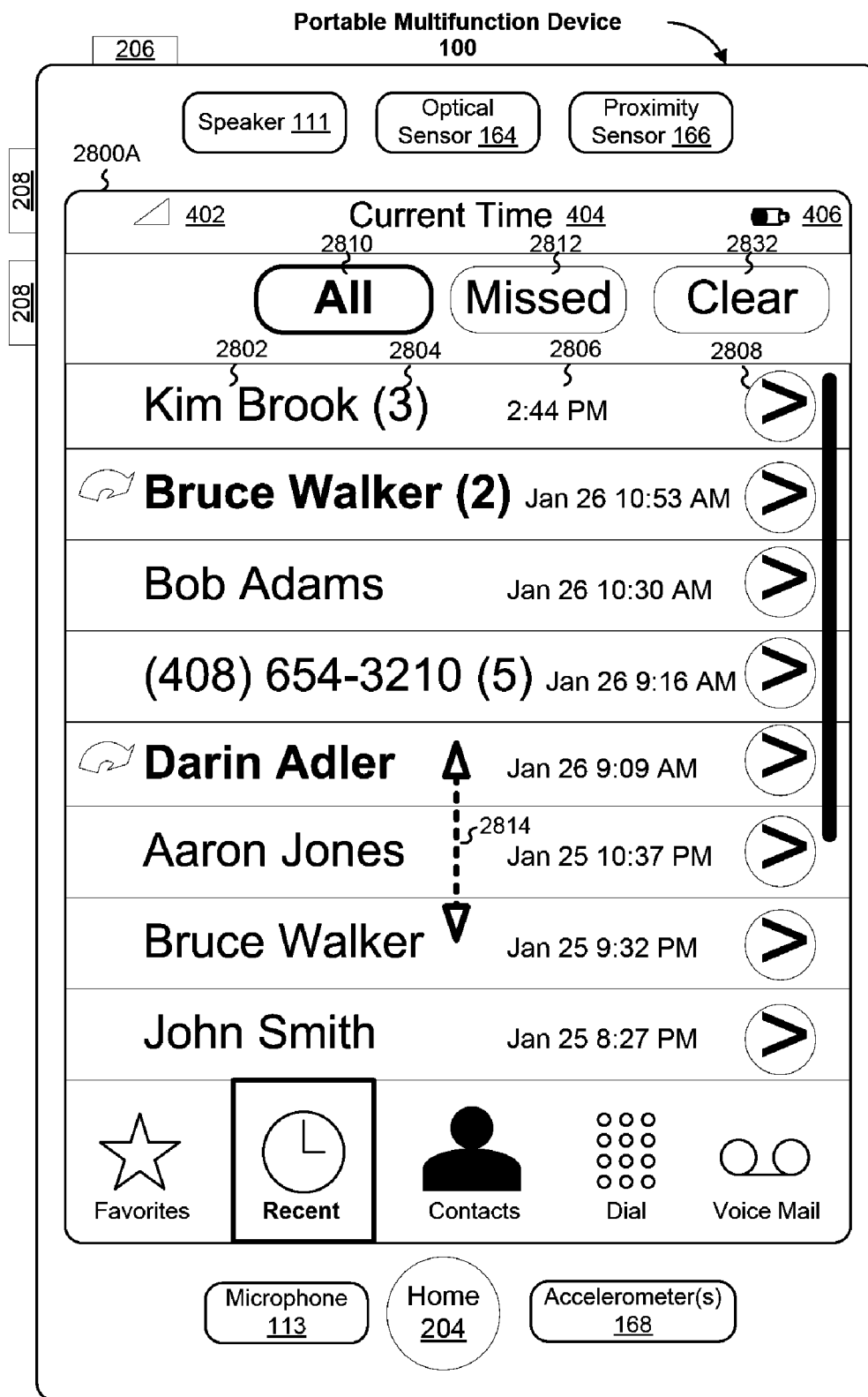


Figure 28A

U.S. Patent

Jan. 20, 2009

Sheet 92 of 293

US 7,479,949 B2

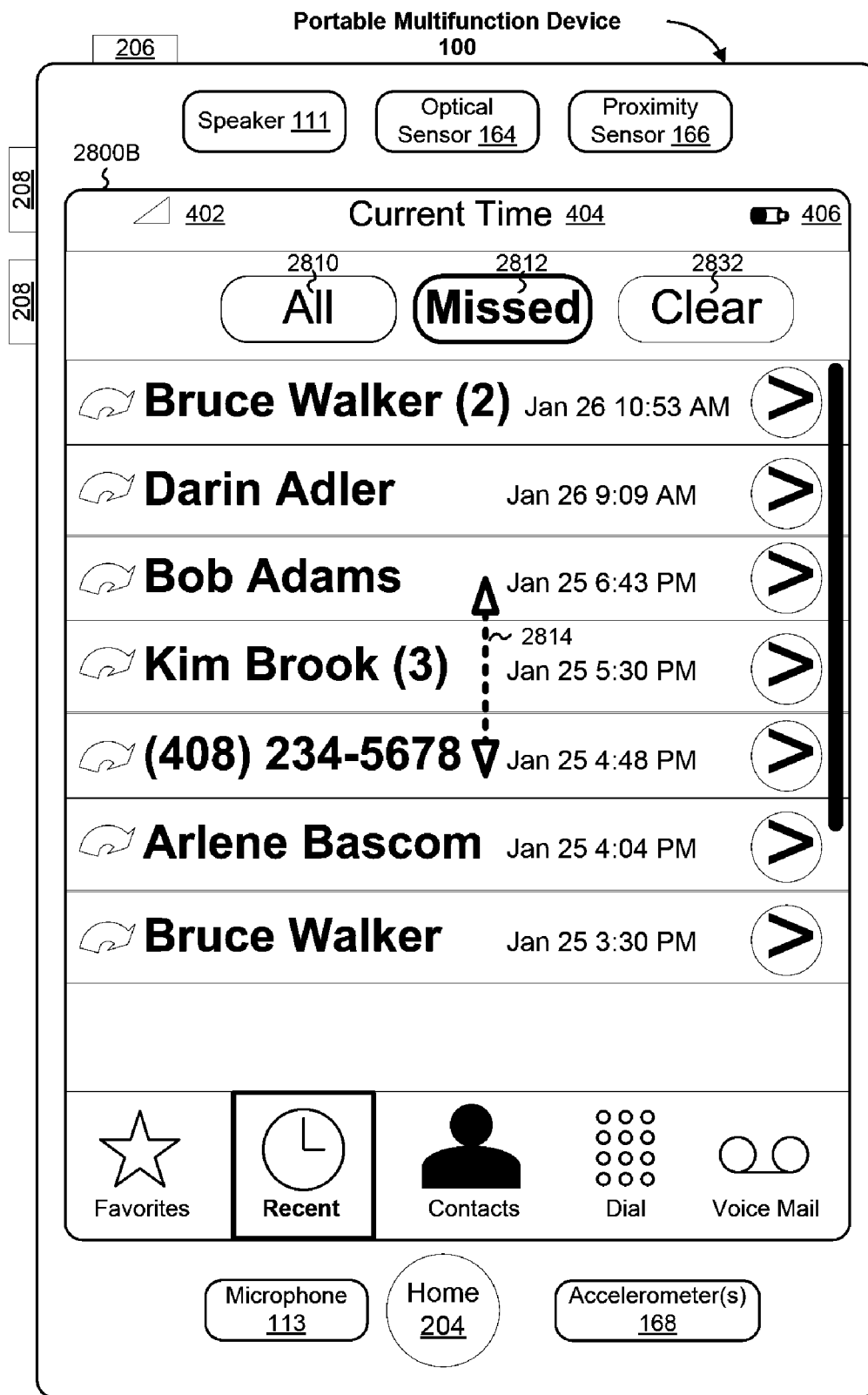


Figure 28B

U.S. Patent

Jan. 20, 2009

Sheet 93 of 293

US 7,479,949 B2

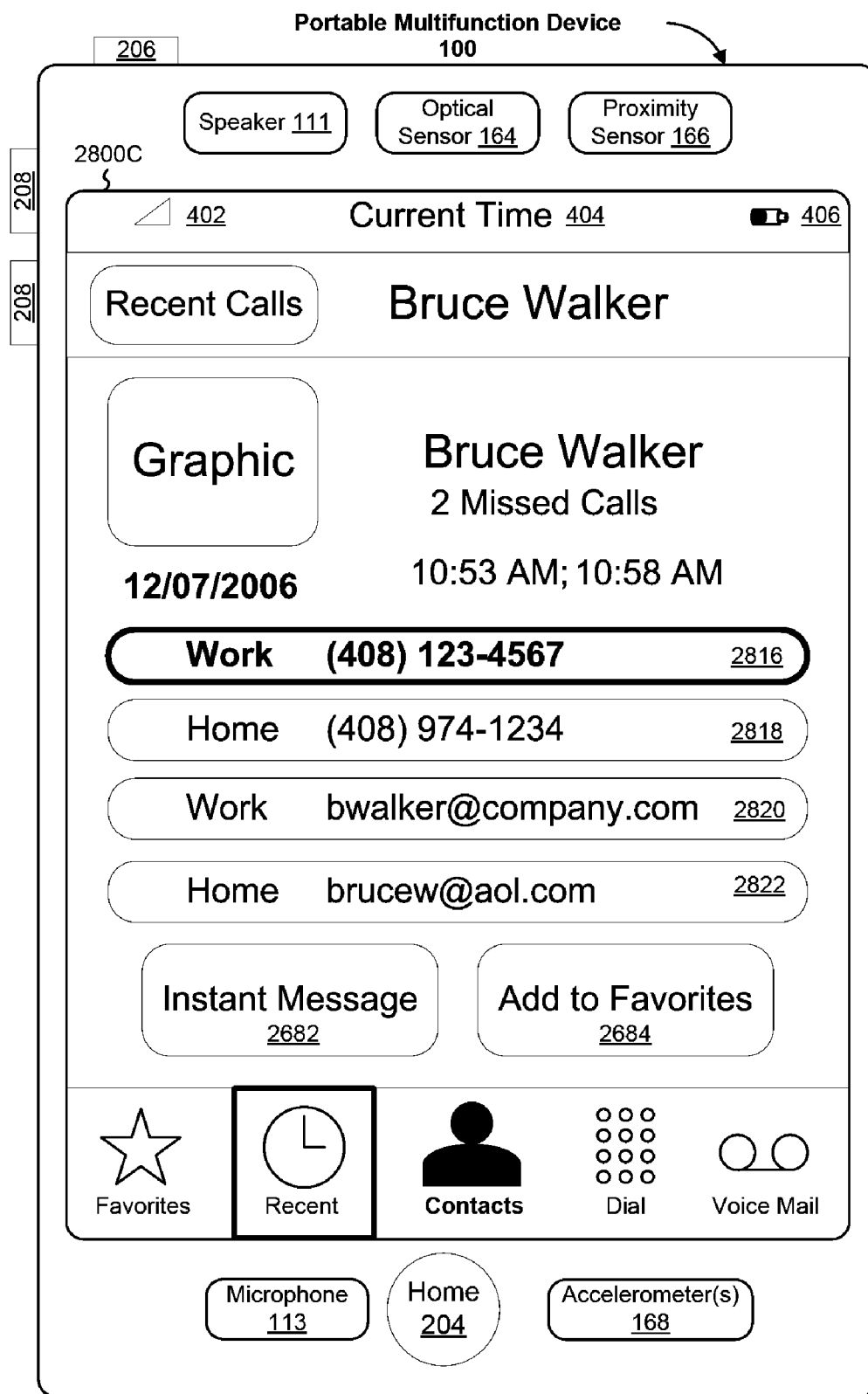


Figure 28C

U.S. Patent

Jan. 20, 2009

Sheet 94 of 293

US 7,479,949 B2

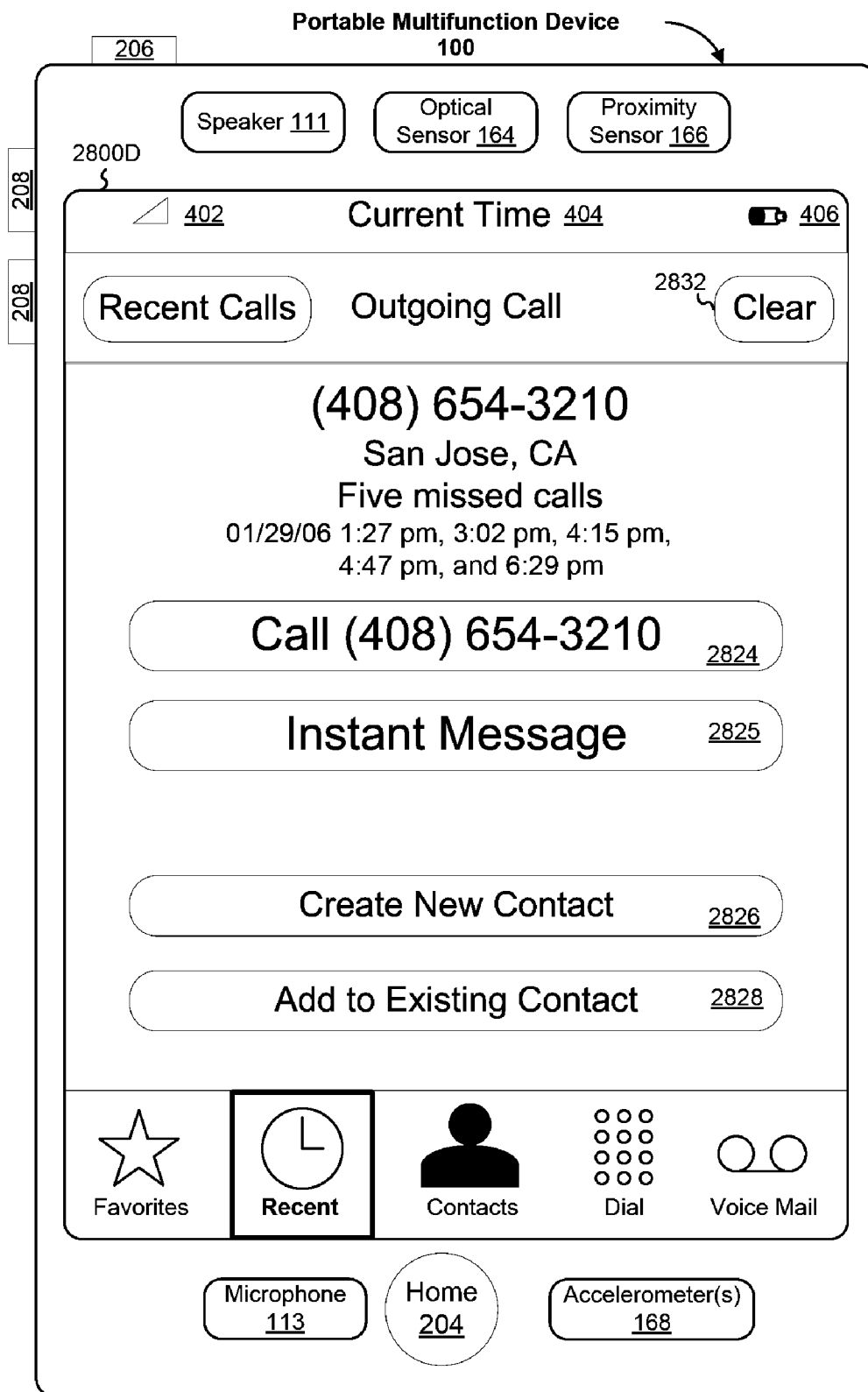


Figure 28D

U.S. Patent

Jan. 20, 2009

Sheet 95 of 293

US 7,479,949 B2

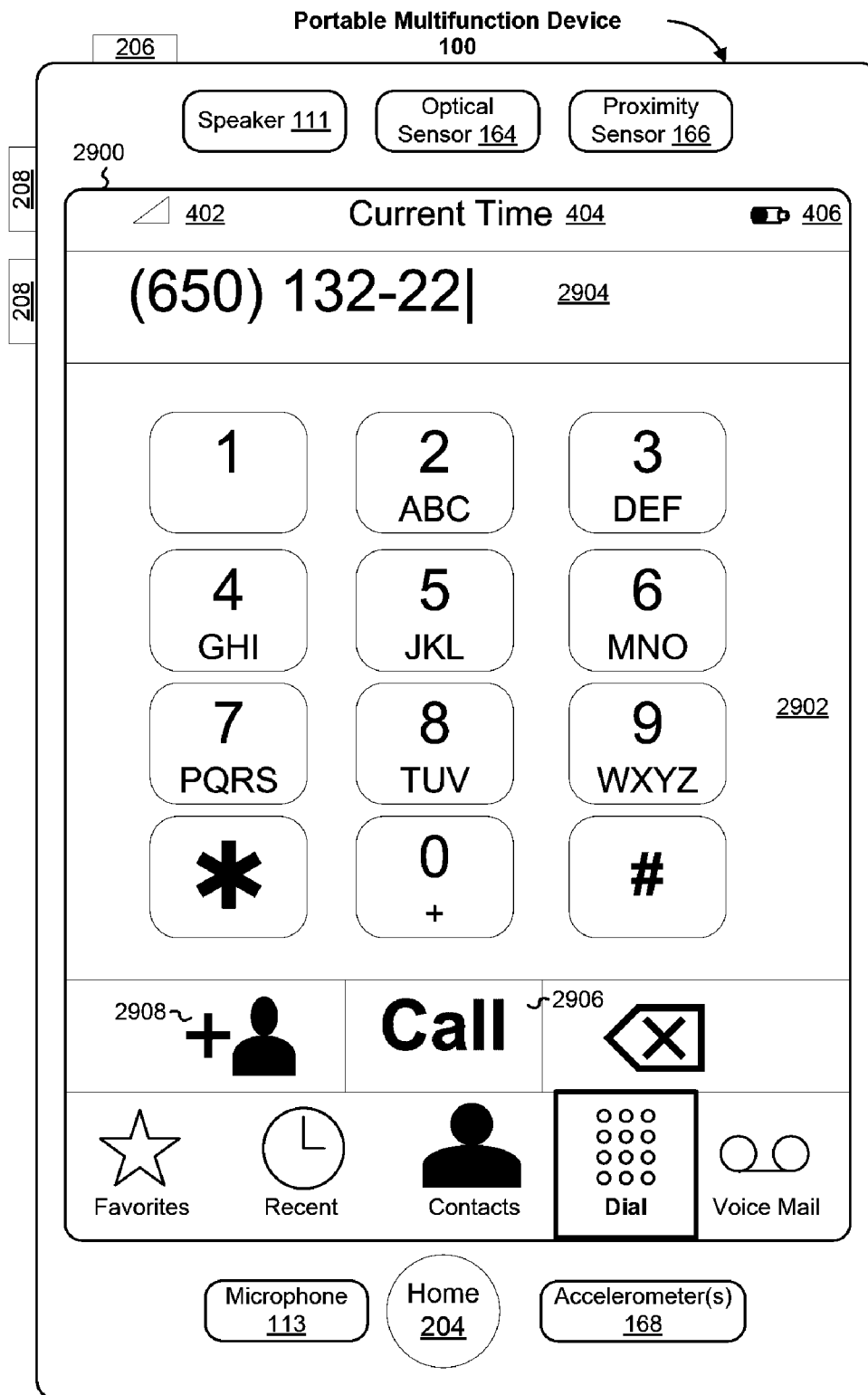


Figure 29

U.S. Patent

Jan. 20, 2009

Sheet 96 of 293

US 7,479,949 B2

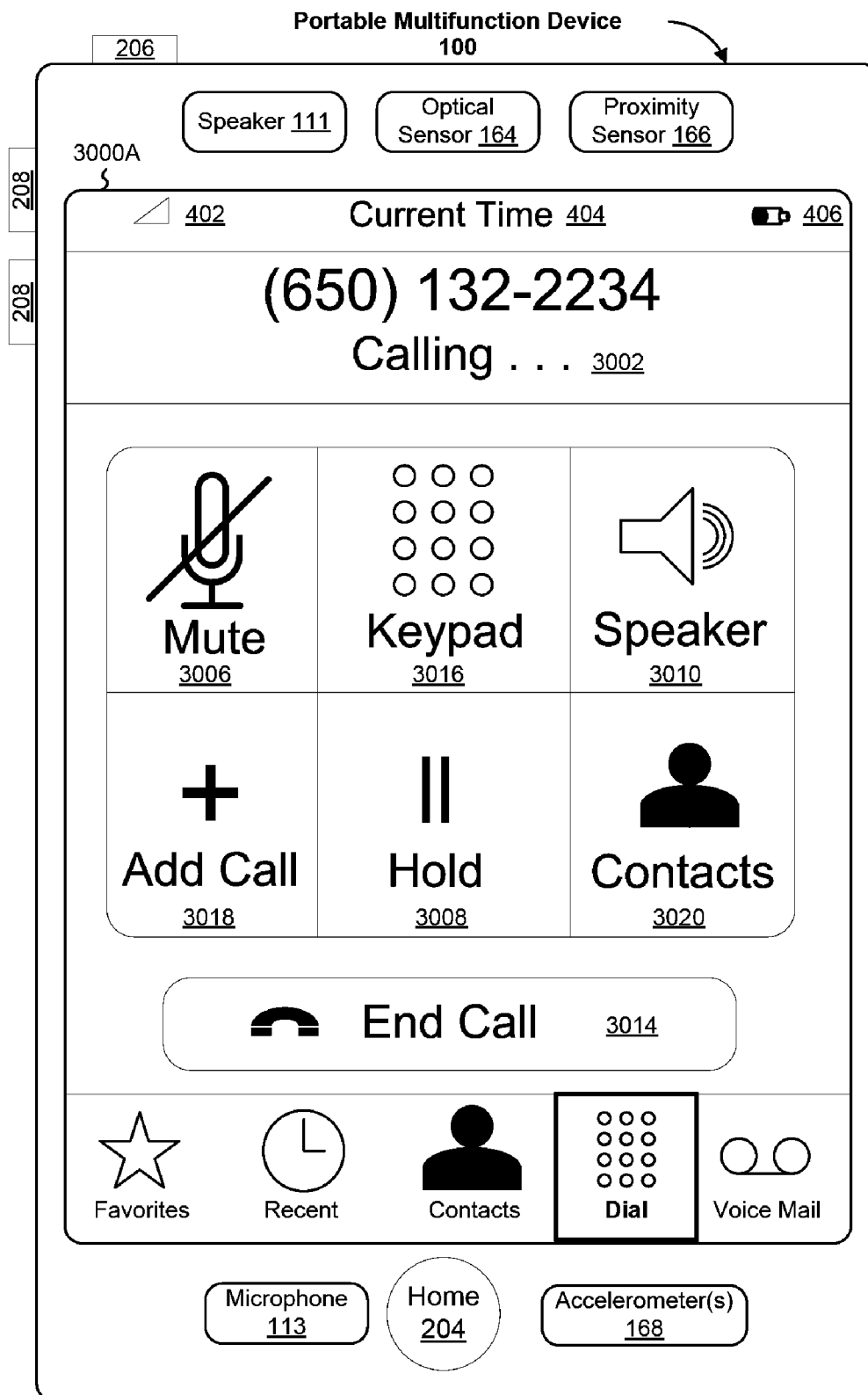


Figure 30A

U.S. Patent

Jan. 20, 2009

Sheet 97 of 293

US 7,479,949 B2

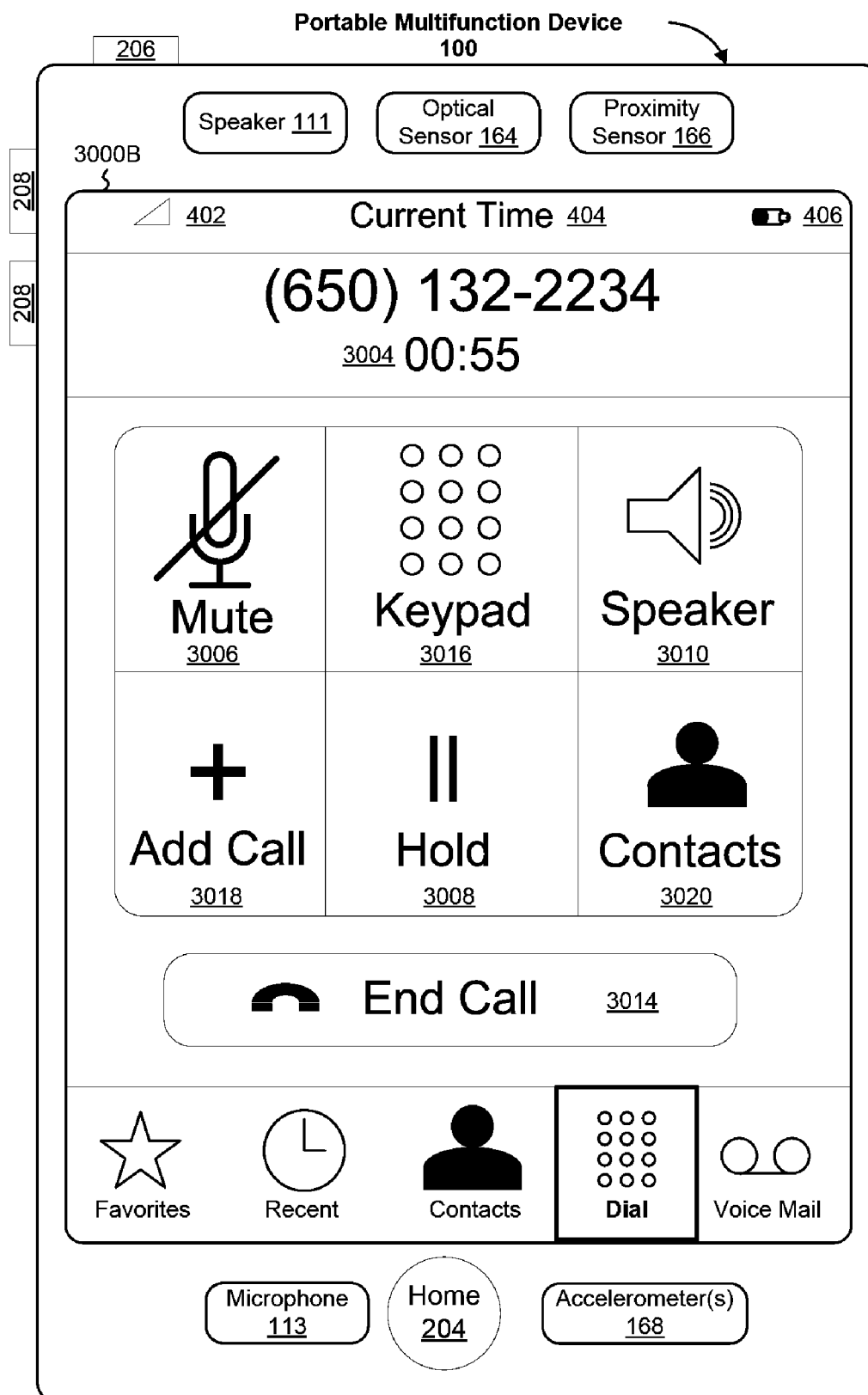


Figure 30B

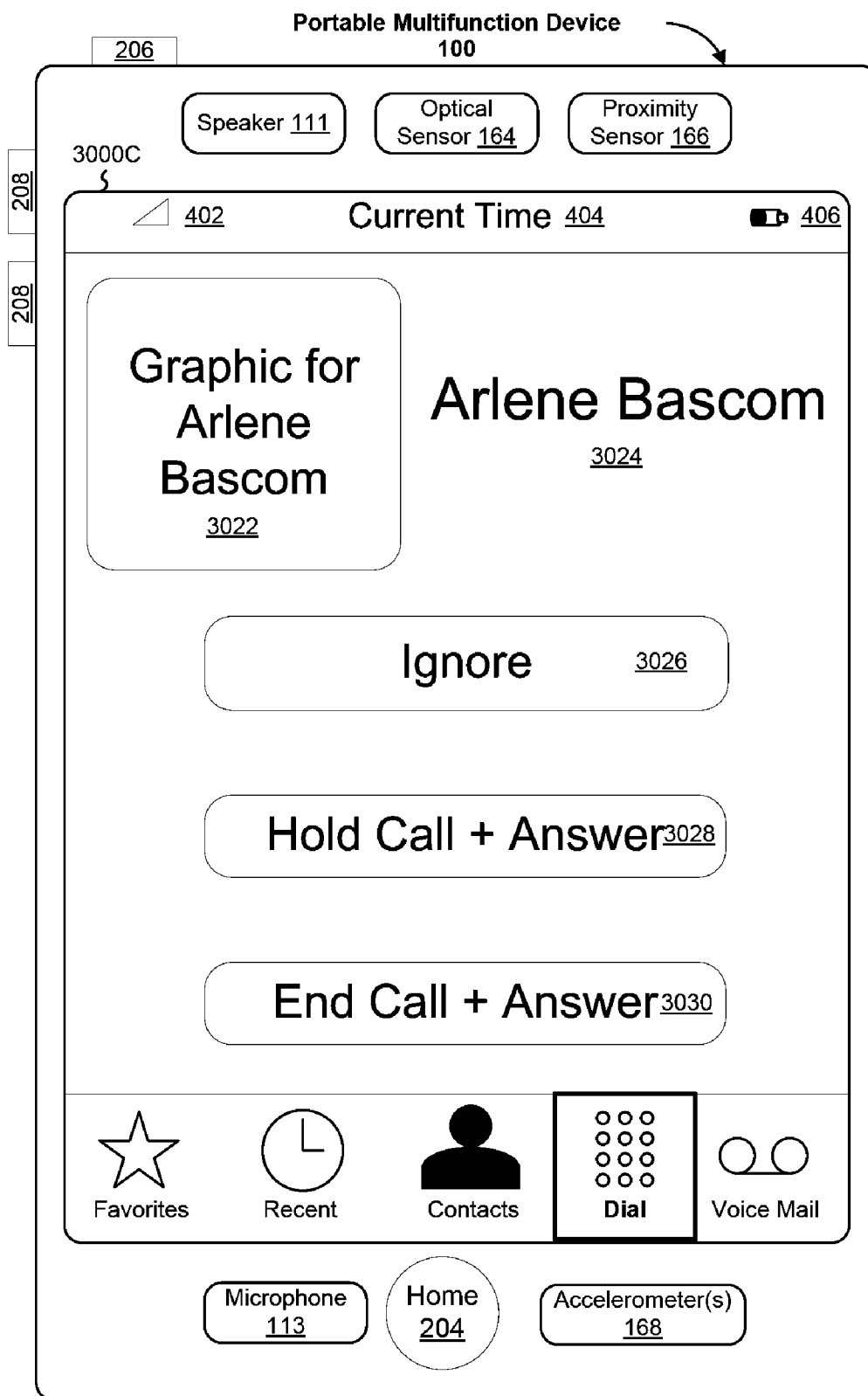


Figure 30C

U.S. Patent

Jan. 20, 2009

Sheet 99 of 293

US 7,479,949 B2

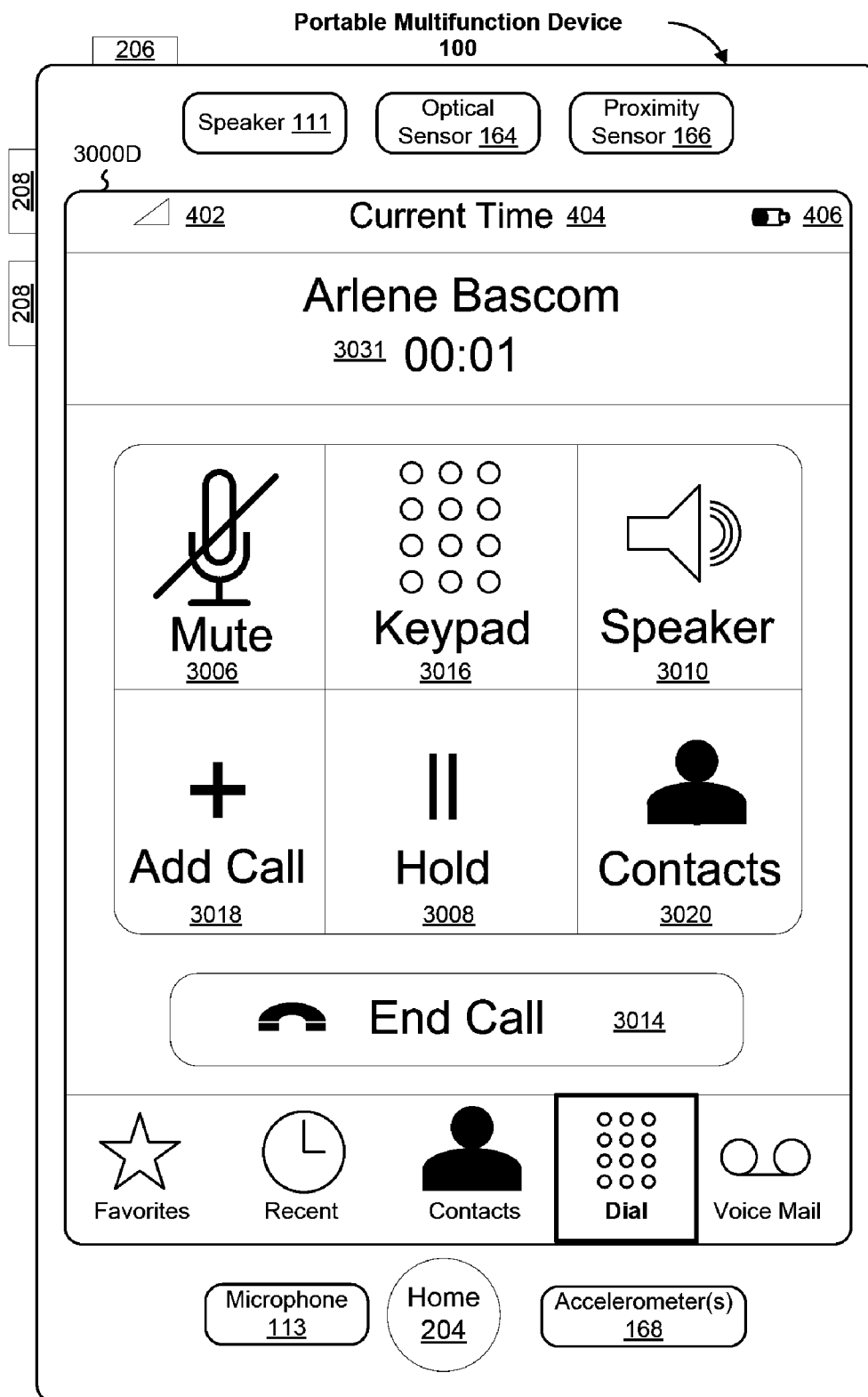


Figure 30D

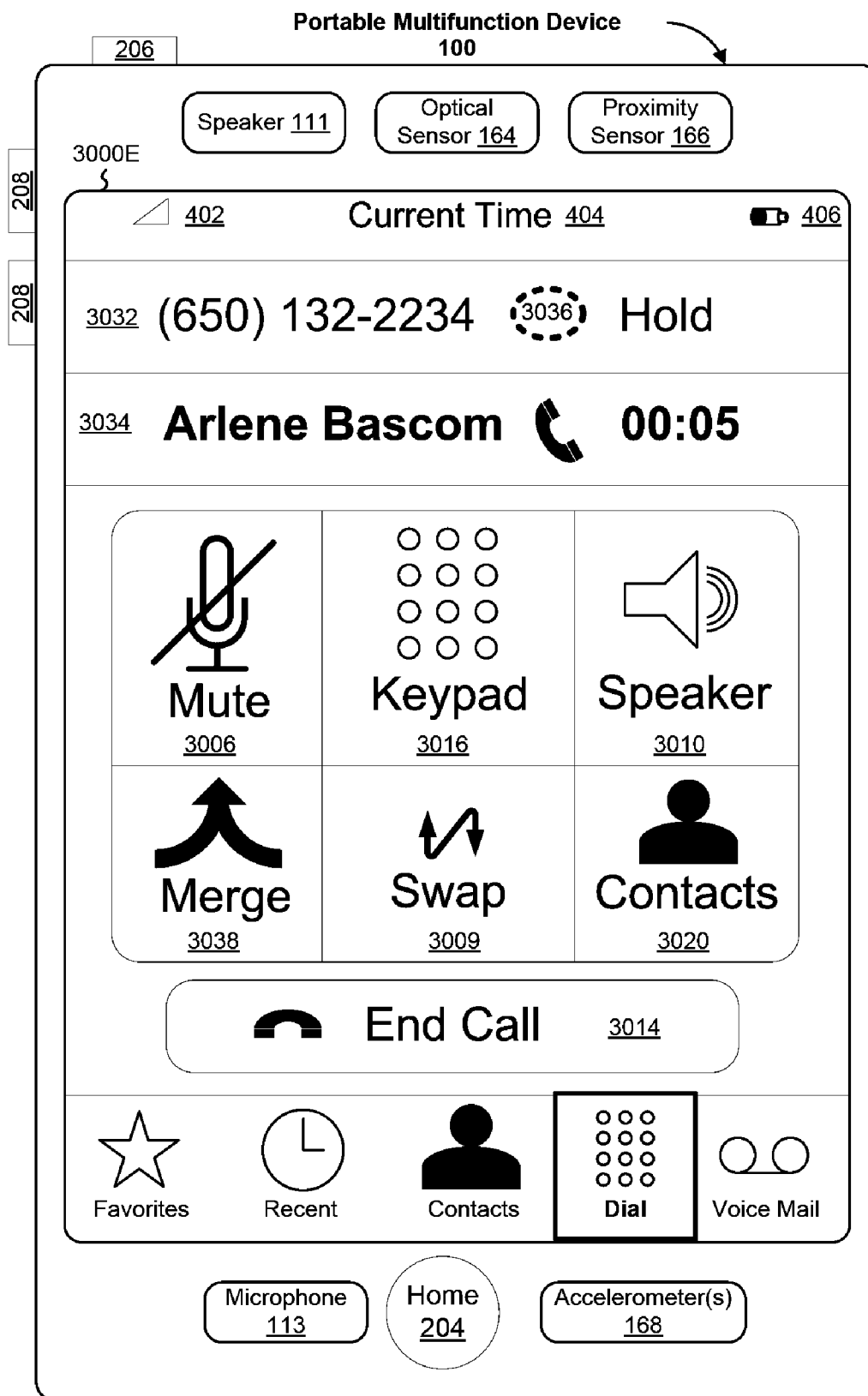


Figure 30E

U.S. Patent

Jan. 20, 2009

Sheet 101 of 293

US 7,479,949 B2

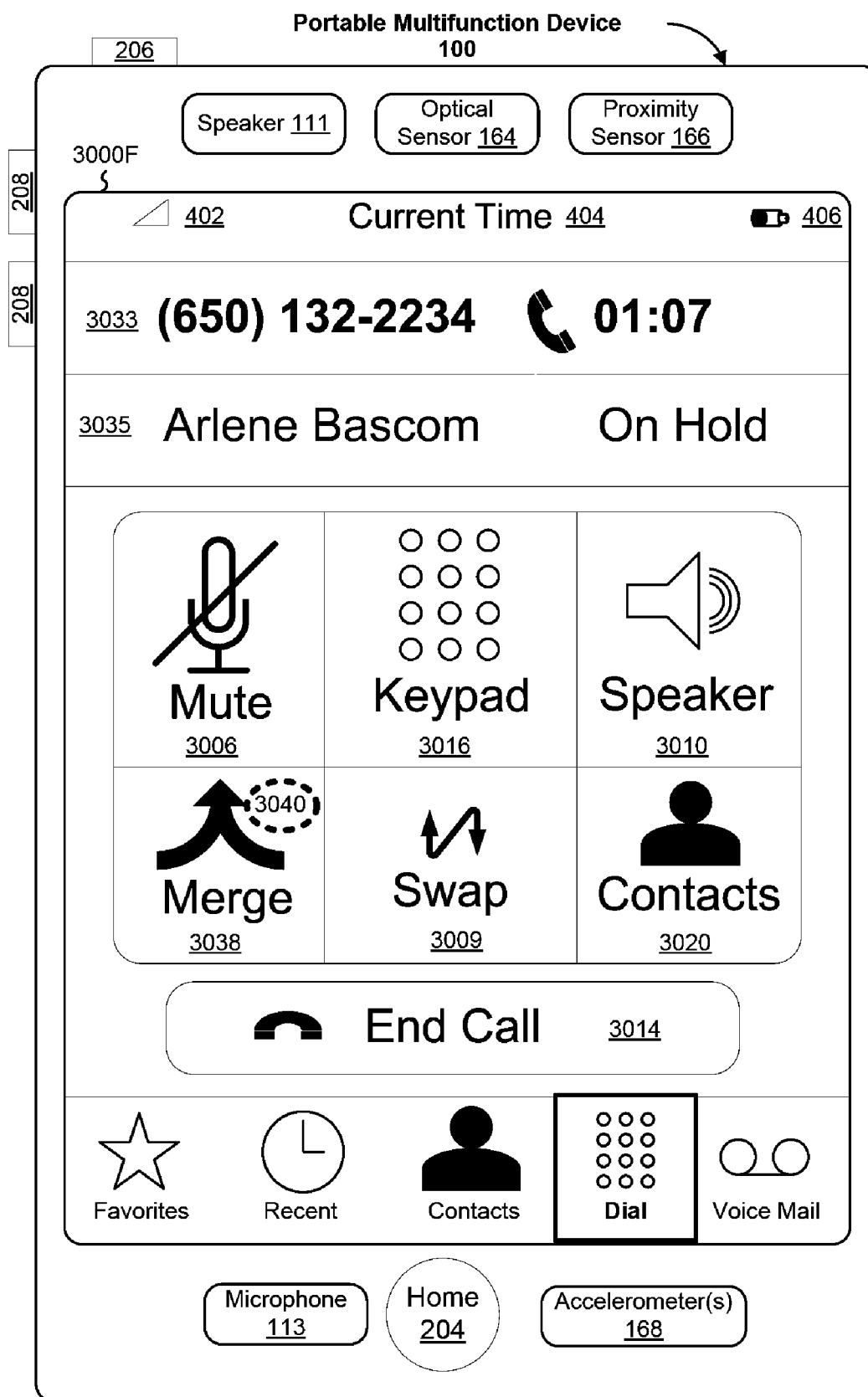


Figure 30F

U.S. Patent

Jan. 20, 2009

Sheet 102 of 293

US 7,479,949 B2

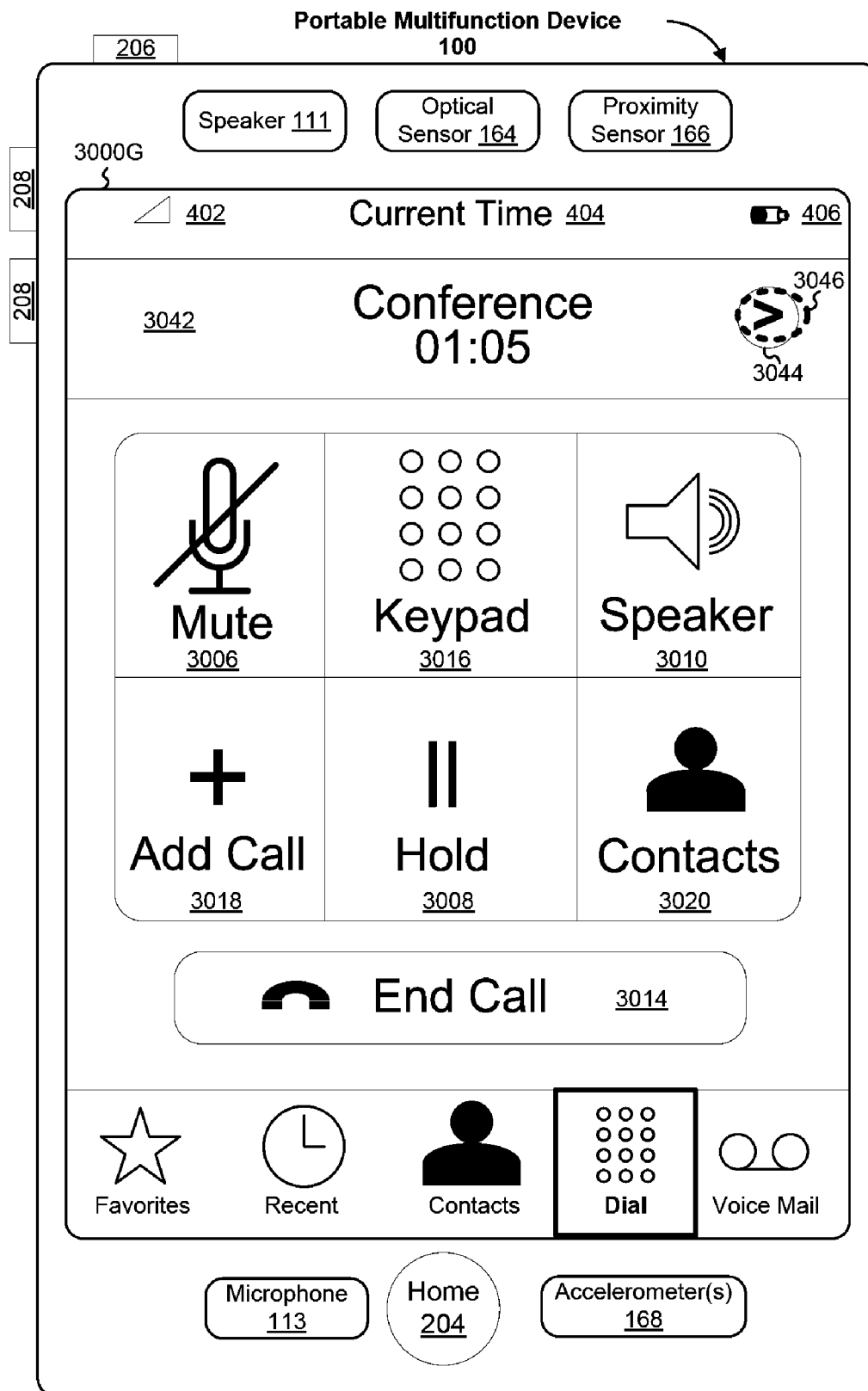


Figure 30G

U.S. Patent

Jan. 20, 2009

Sheet 103 of 293

US 7,479,949 B2



Figure 30H

U.S. Patent

Jan. 20, 2009

Sheet 104 of 293

US 7,479,949 B2

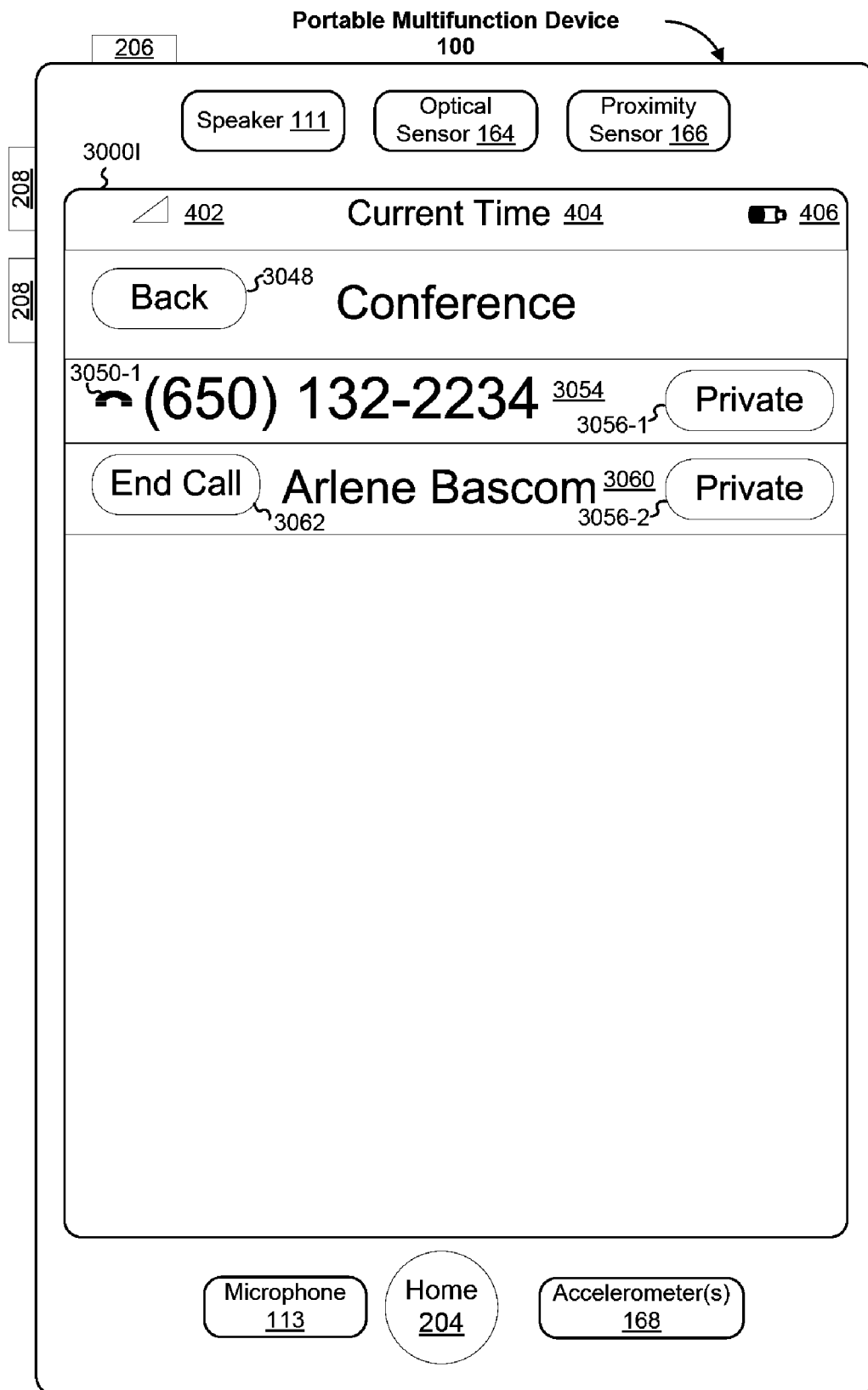


Figure 30I

U.S. Patent

Jan. 20, 2009

Sheet 105 of 293

US 7,479,949 B2

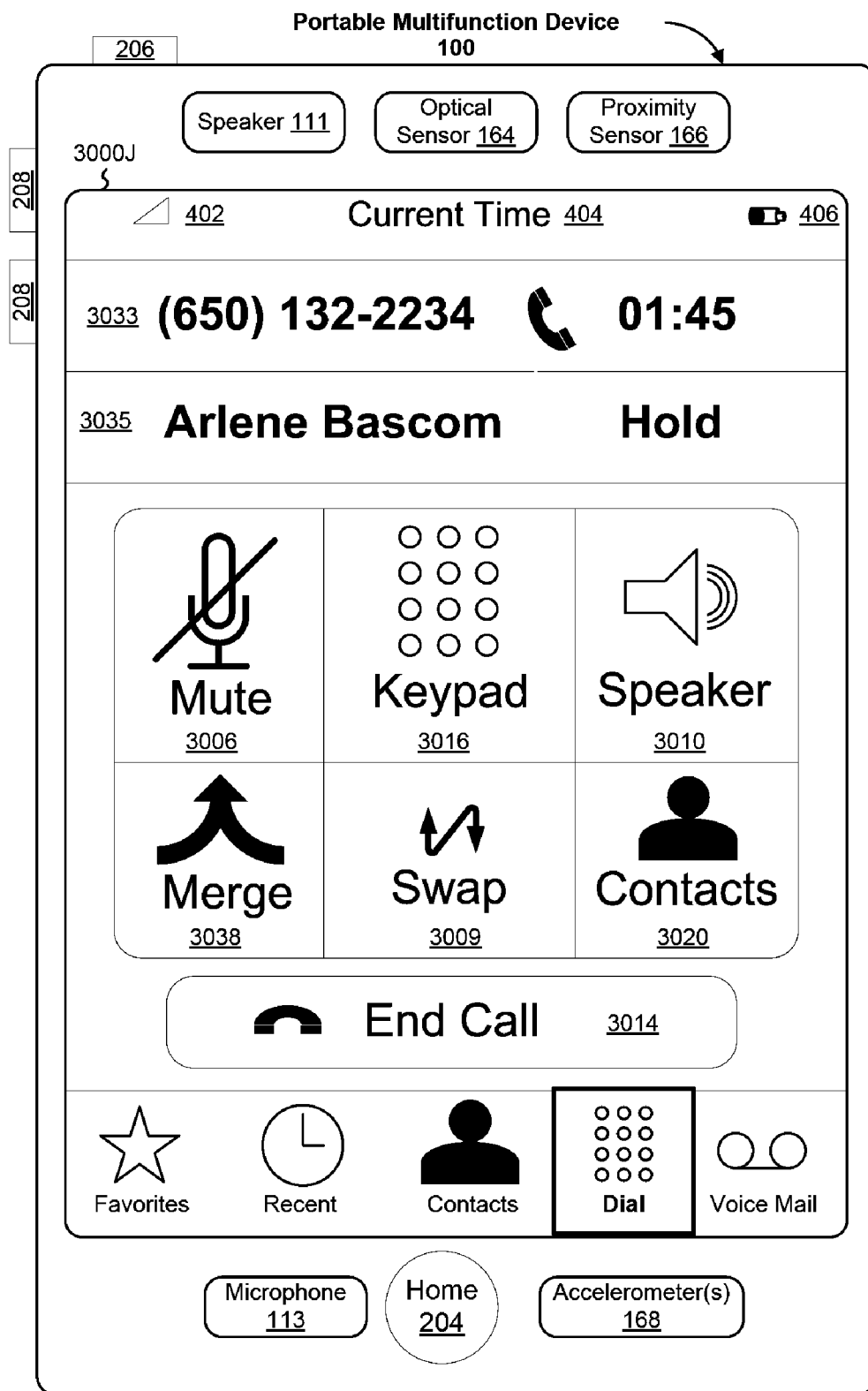


Figure 30J

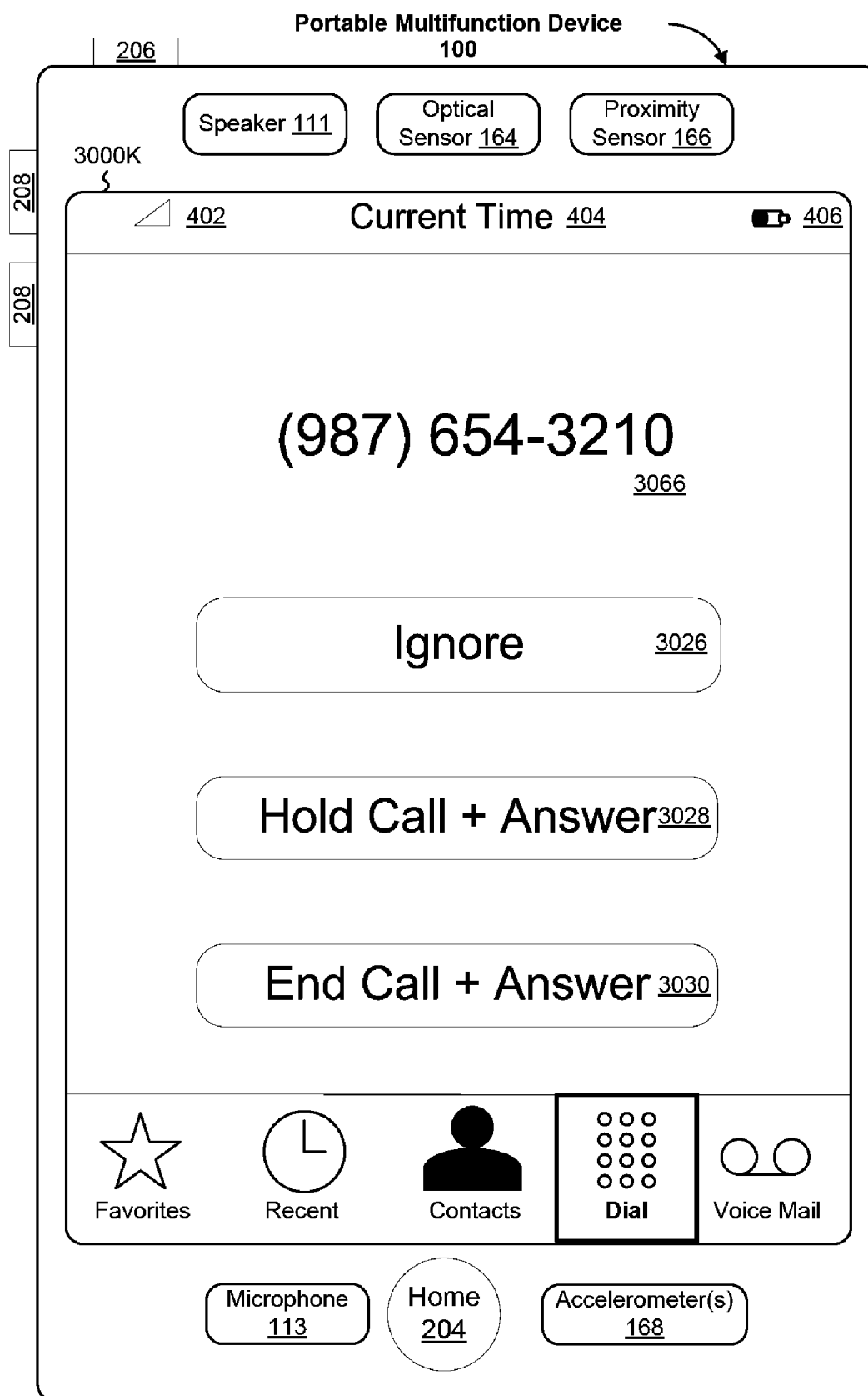


Figure 30K

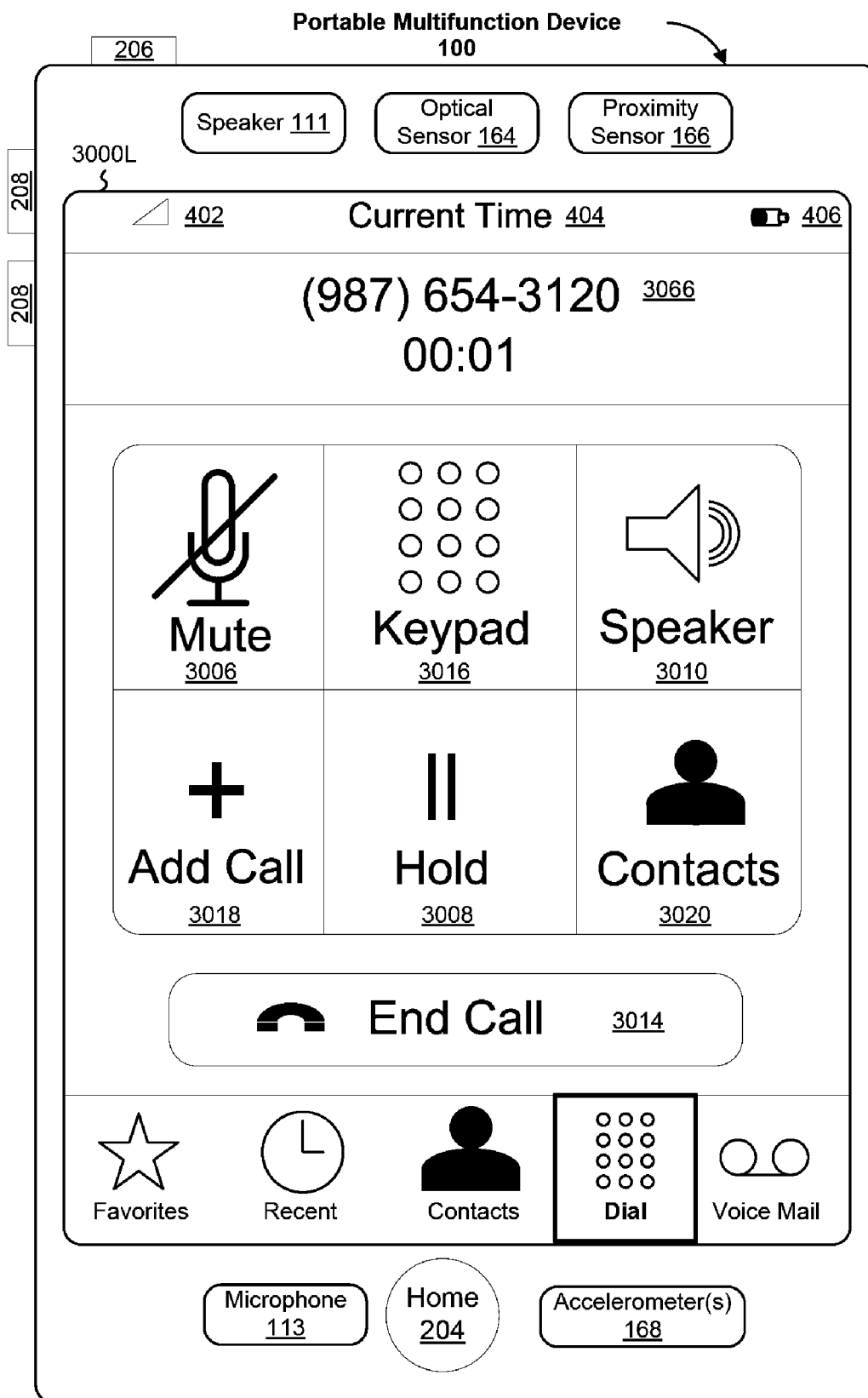


Figure 30L

U.S. Patent

Jan. 20, 2009

Sheet 108 of 293

US 7,479,949 B2

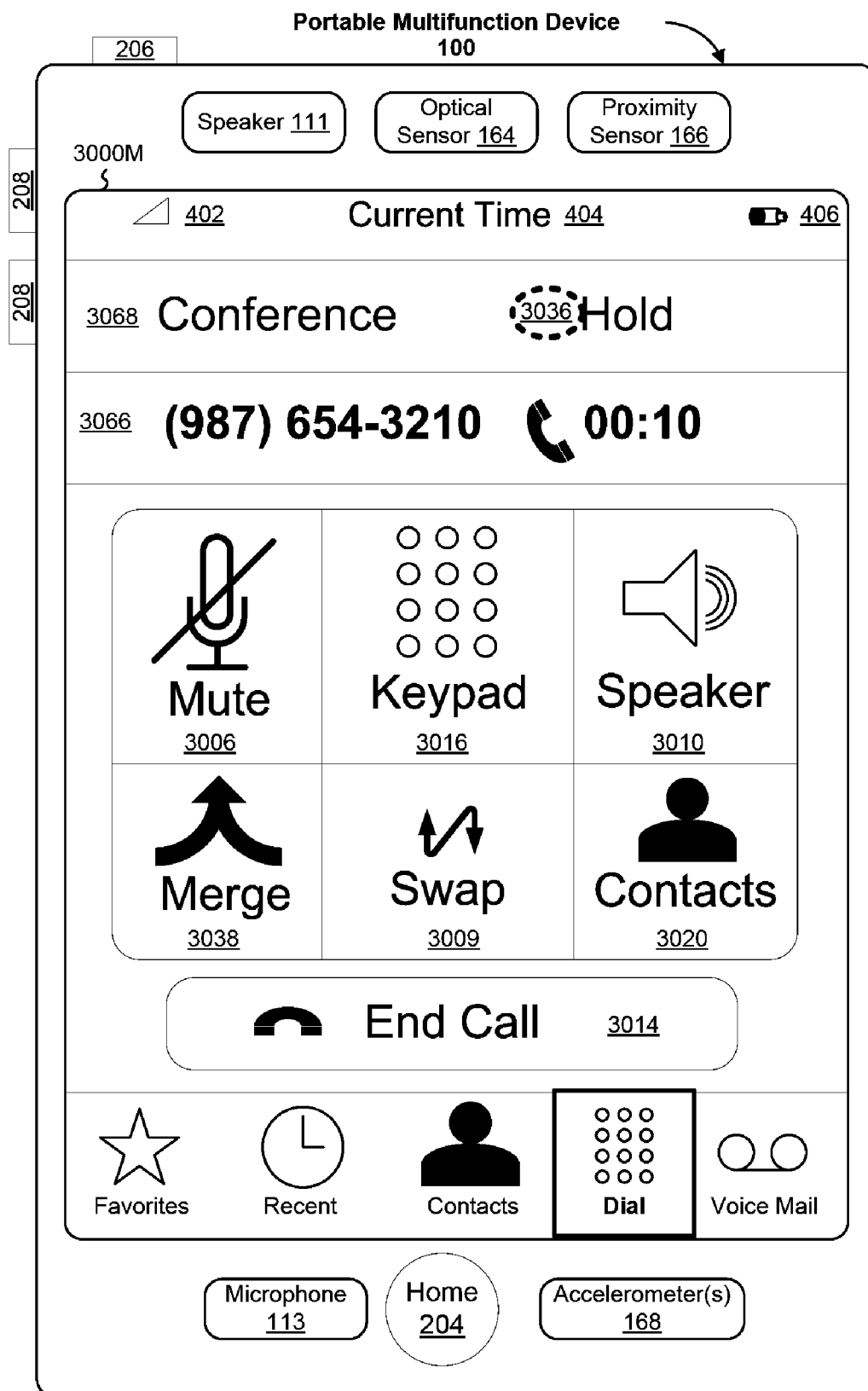


Figure 30M

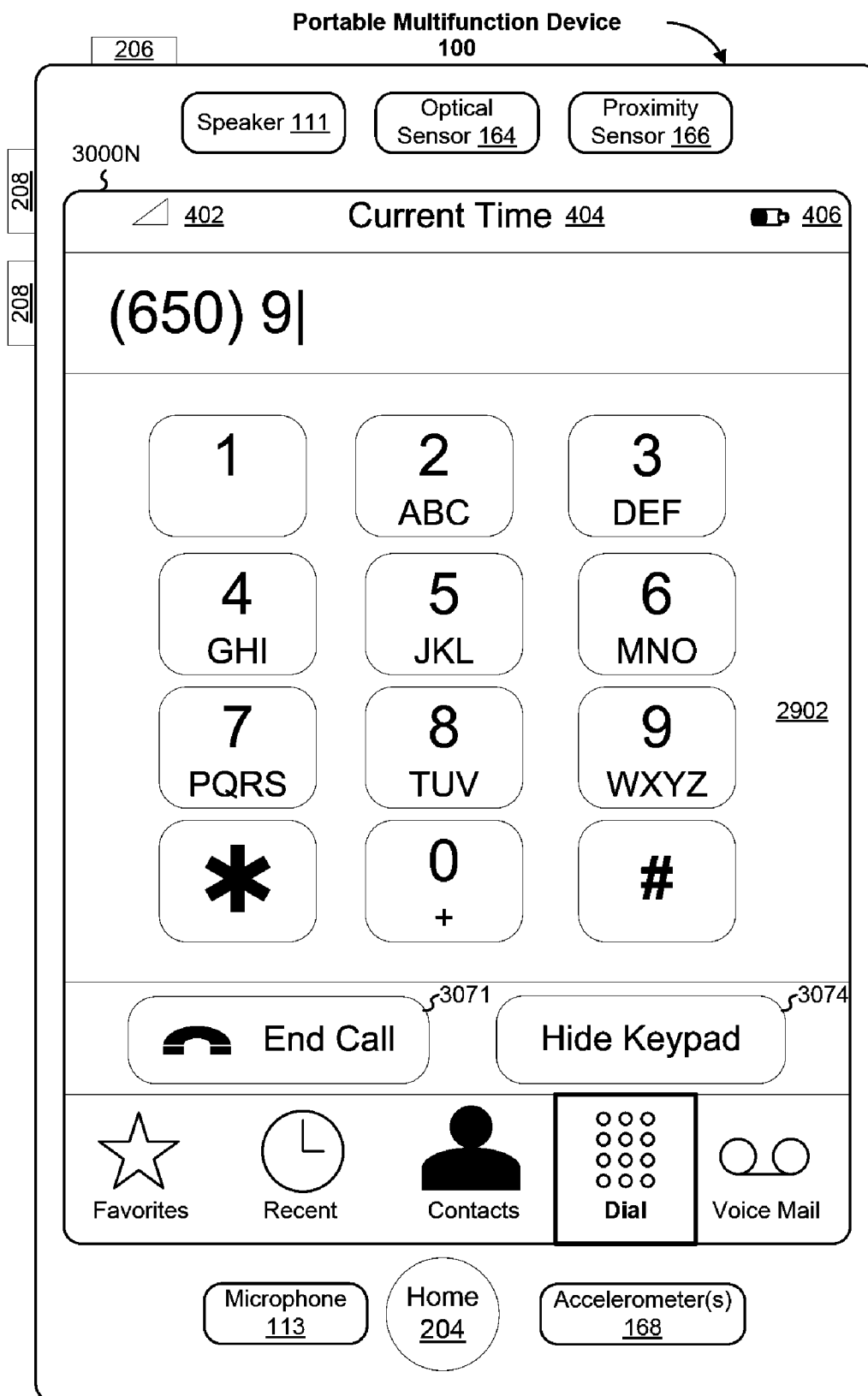


Figure 30N

U.S. Patent

Jan. 20, 2009

Sheet 110 of 293

US 7,479,949 B2

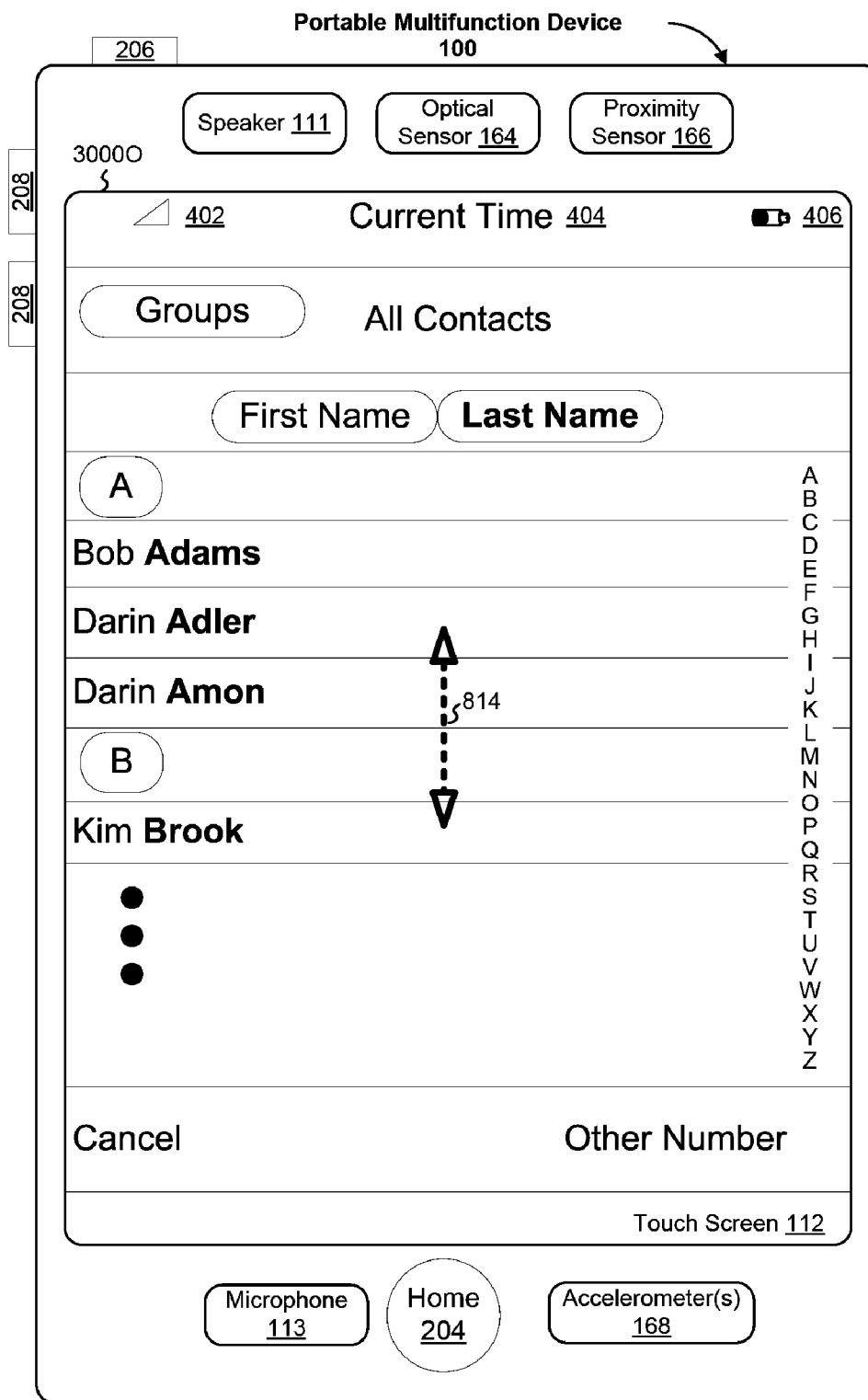


Figure 300

U.S. Patent

Jan. 20, 2009

Sheet 111 of 293

US 7,479,949 B2

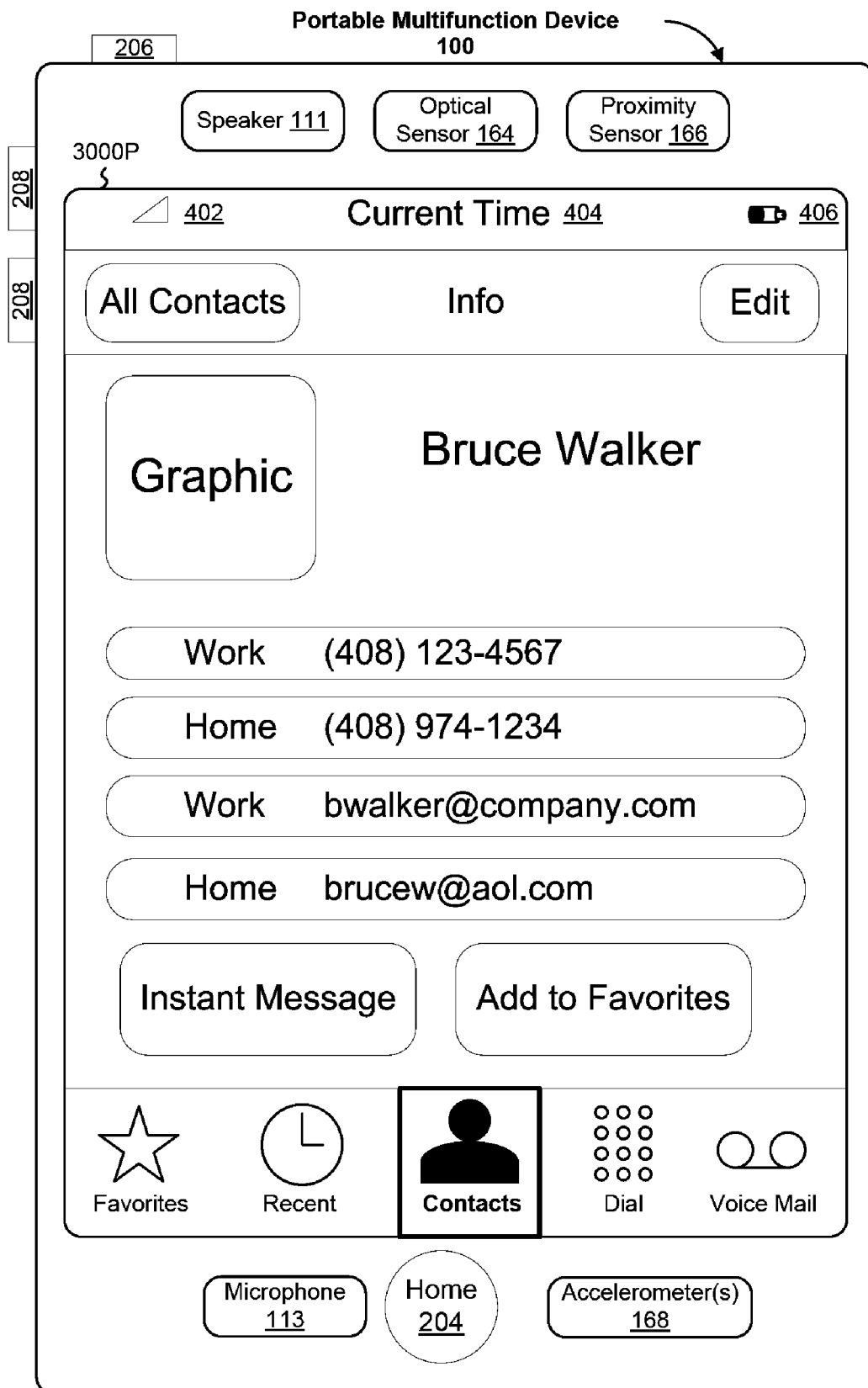


Figure 30P

U.S. Patent

Jan. 20, 2009

Sheet 112 of 293

US 7,479,949 B2

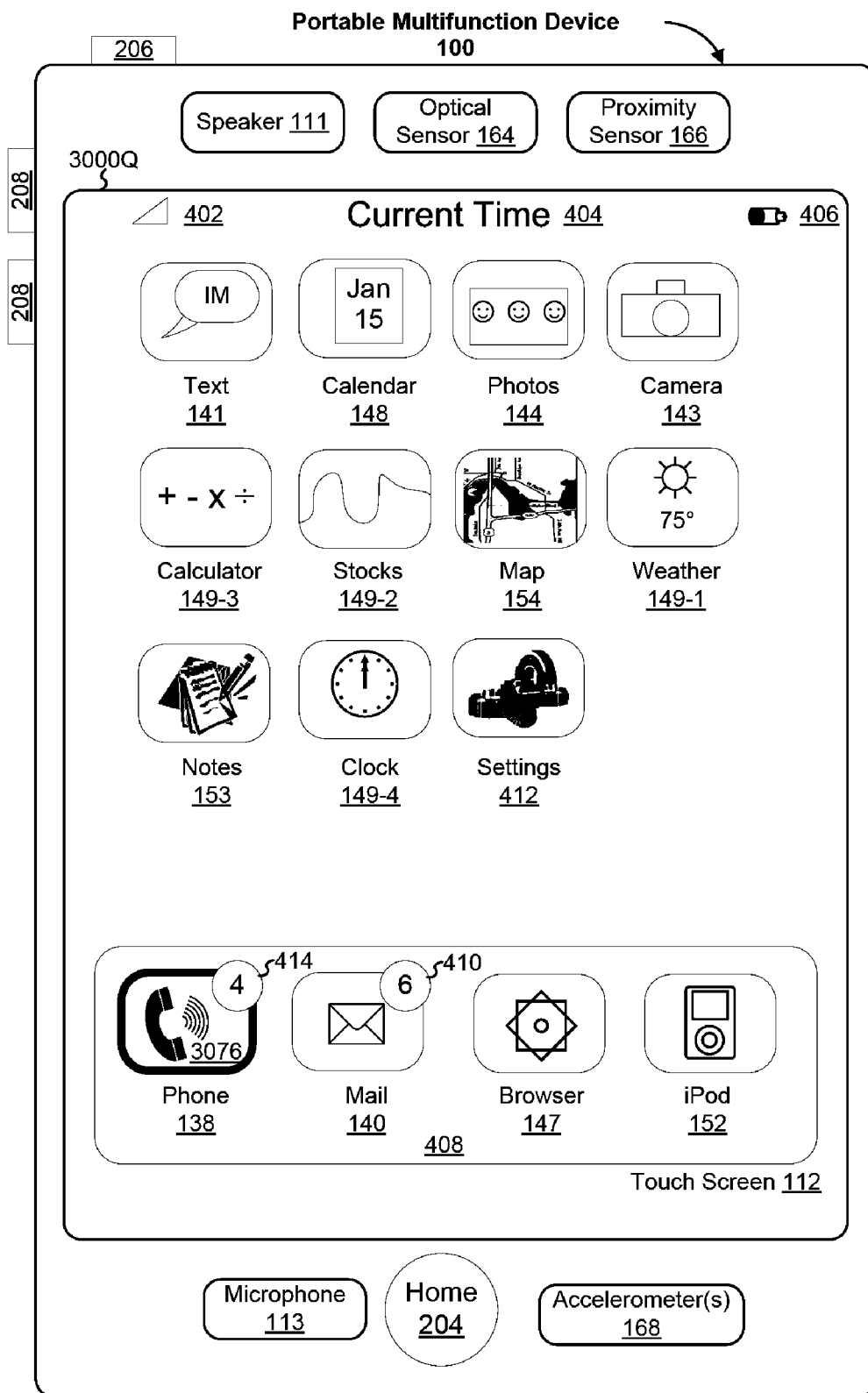


Figure 30Q

U.S. Patent

Jan. 20, 2009

Sheet 113 of 293

US 7,479,949 B2

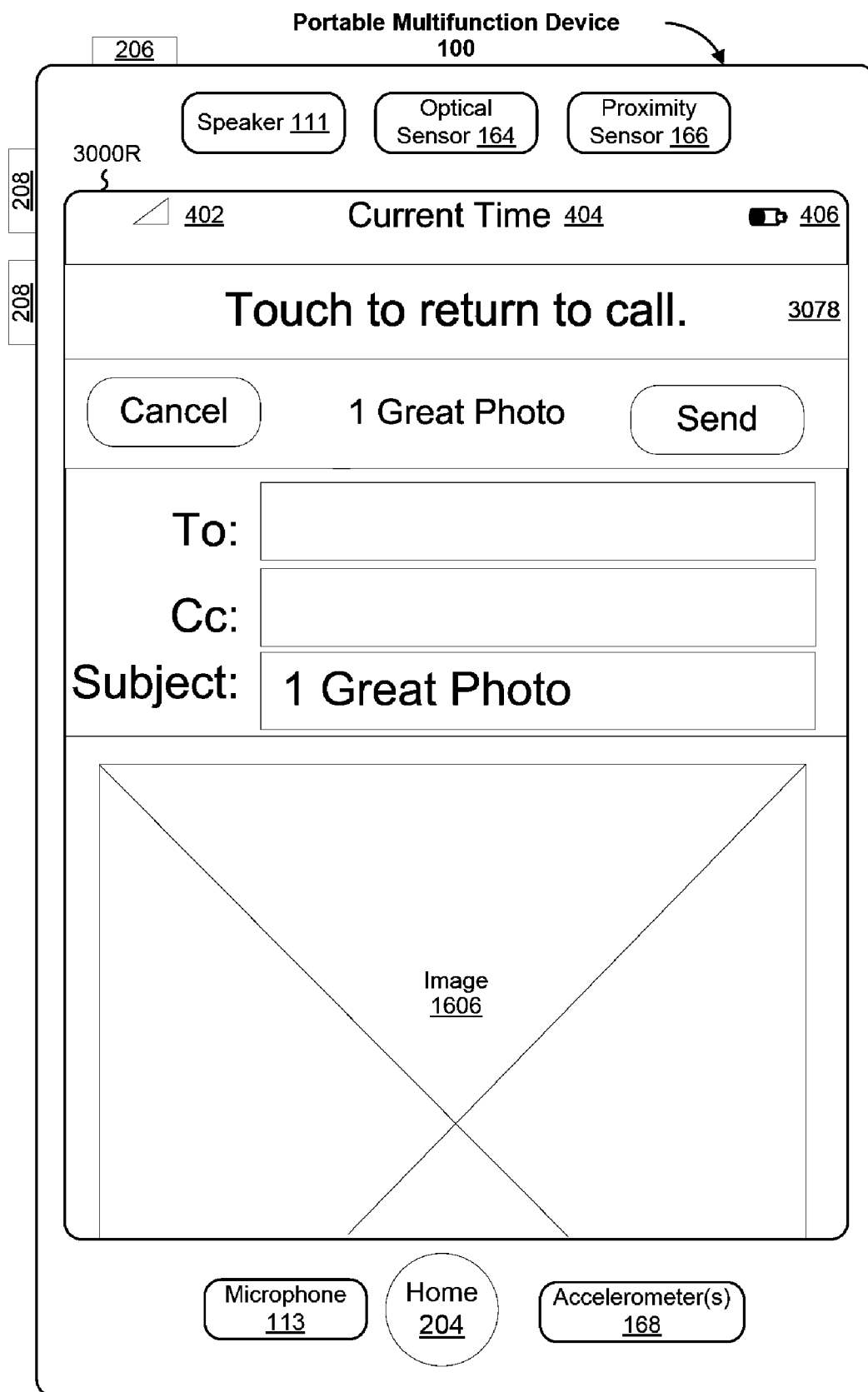


Figure 30R

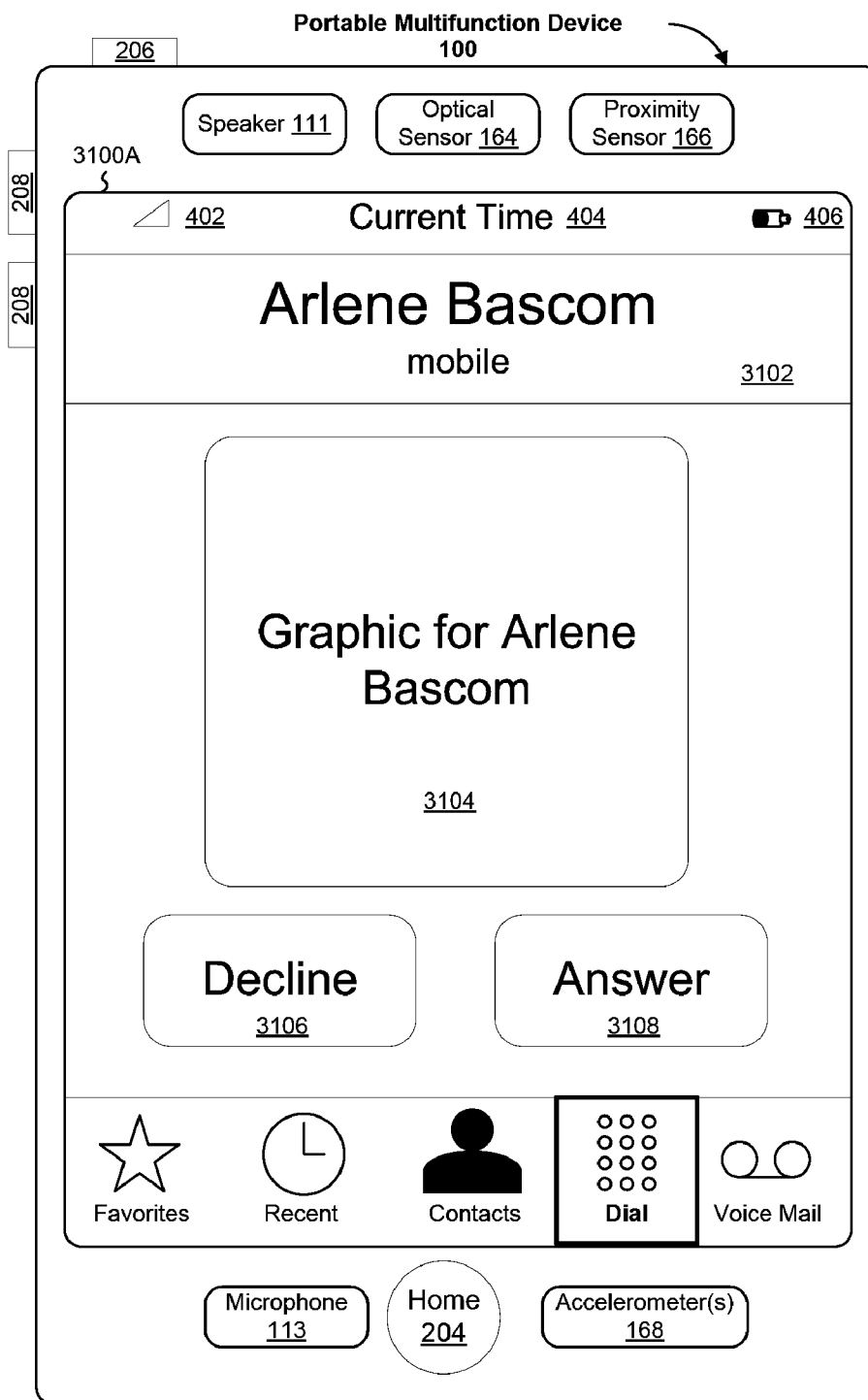


Figure 31A

U.S. Patent

Jan. 20, 2009

Sheet 115 of 293

US 7,479,949 B2



Figure 31B

U.S. Patent

Jan. 20, 2009

Sheet 116 of 293

US 7,479,949 B2

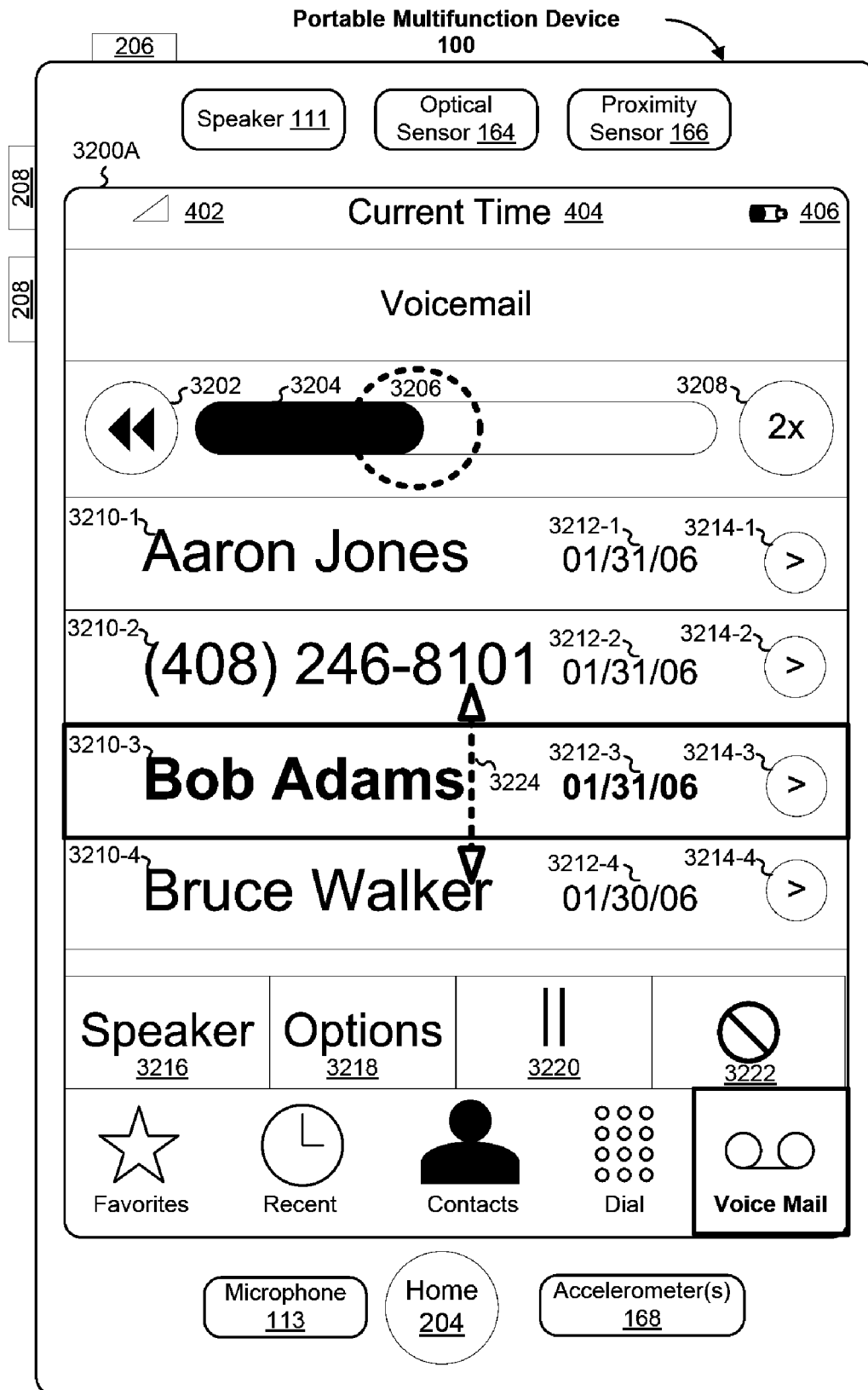


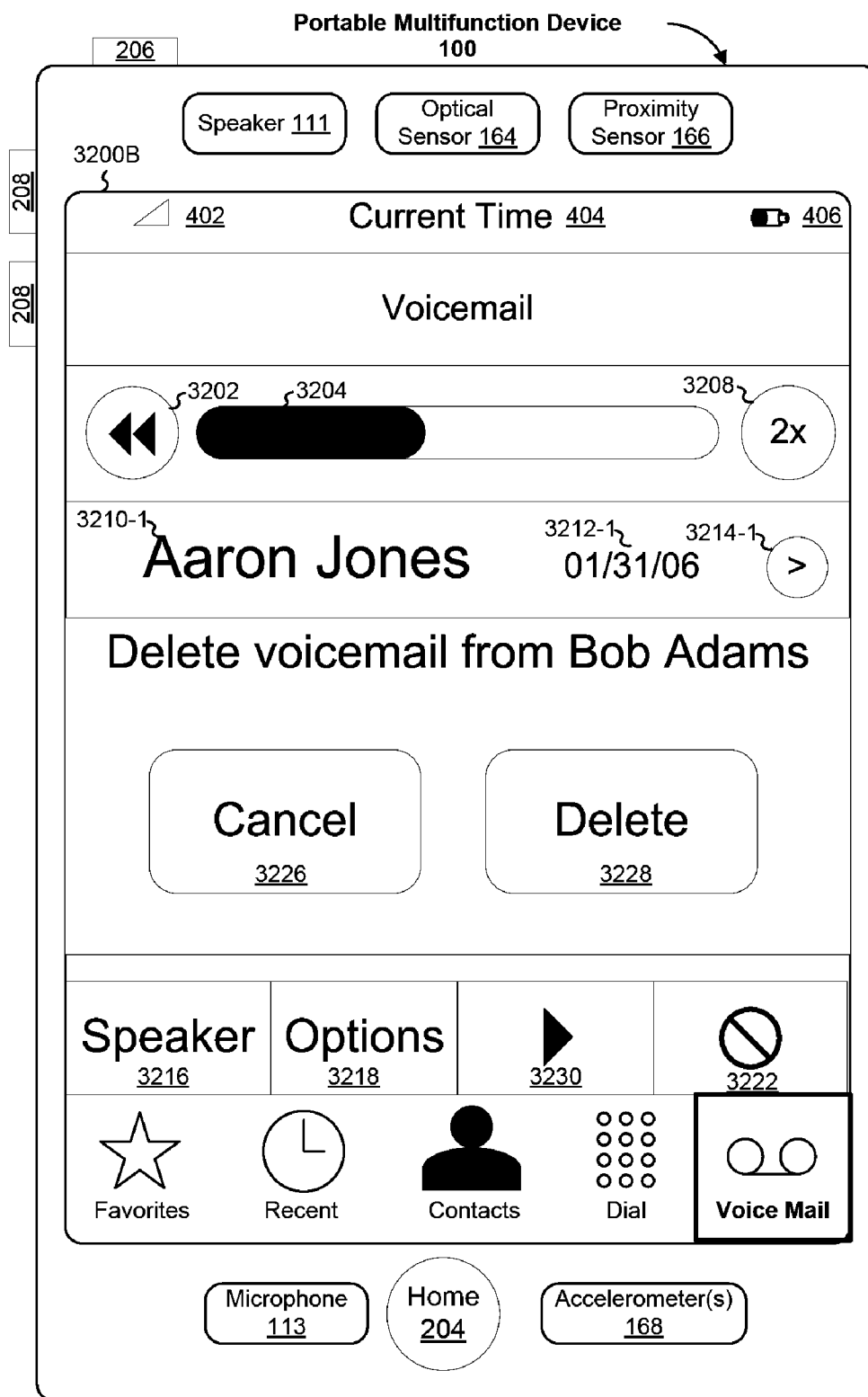
Figure 32A

U.S. Patent

Jan. 20, 2009

Sheet 117 of 293

US 7,479,949 B2

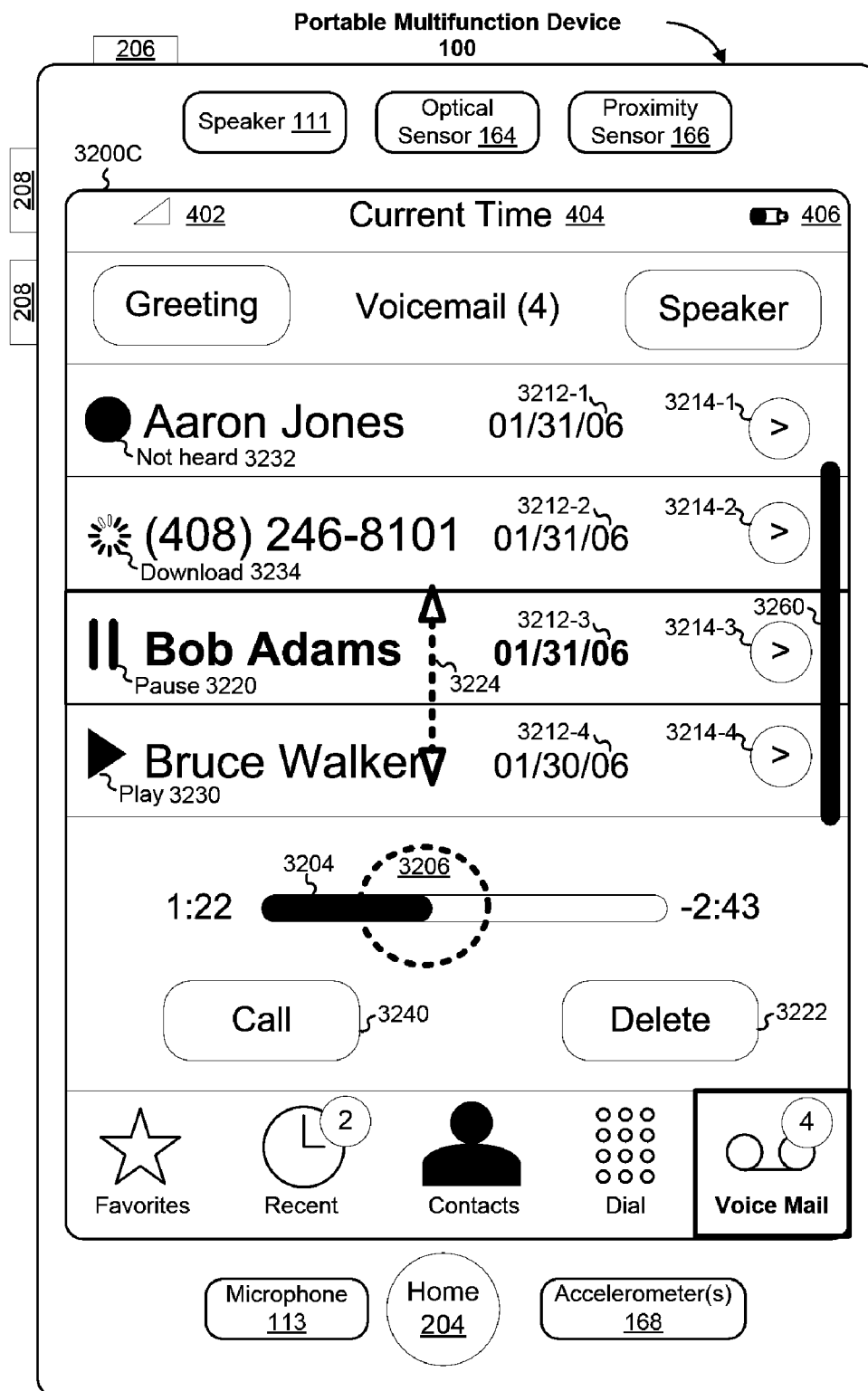


U.S. Patent

Jan. 20, 2009

Sheet 118 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 119 of 293

US 7,479,949 B2

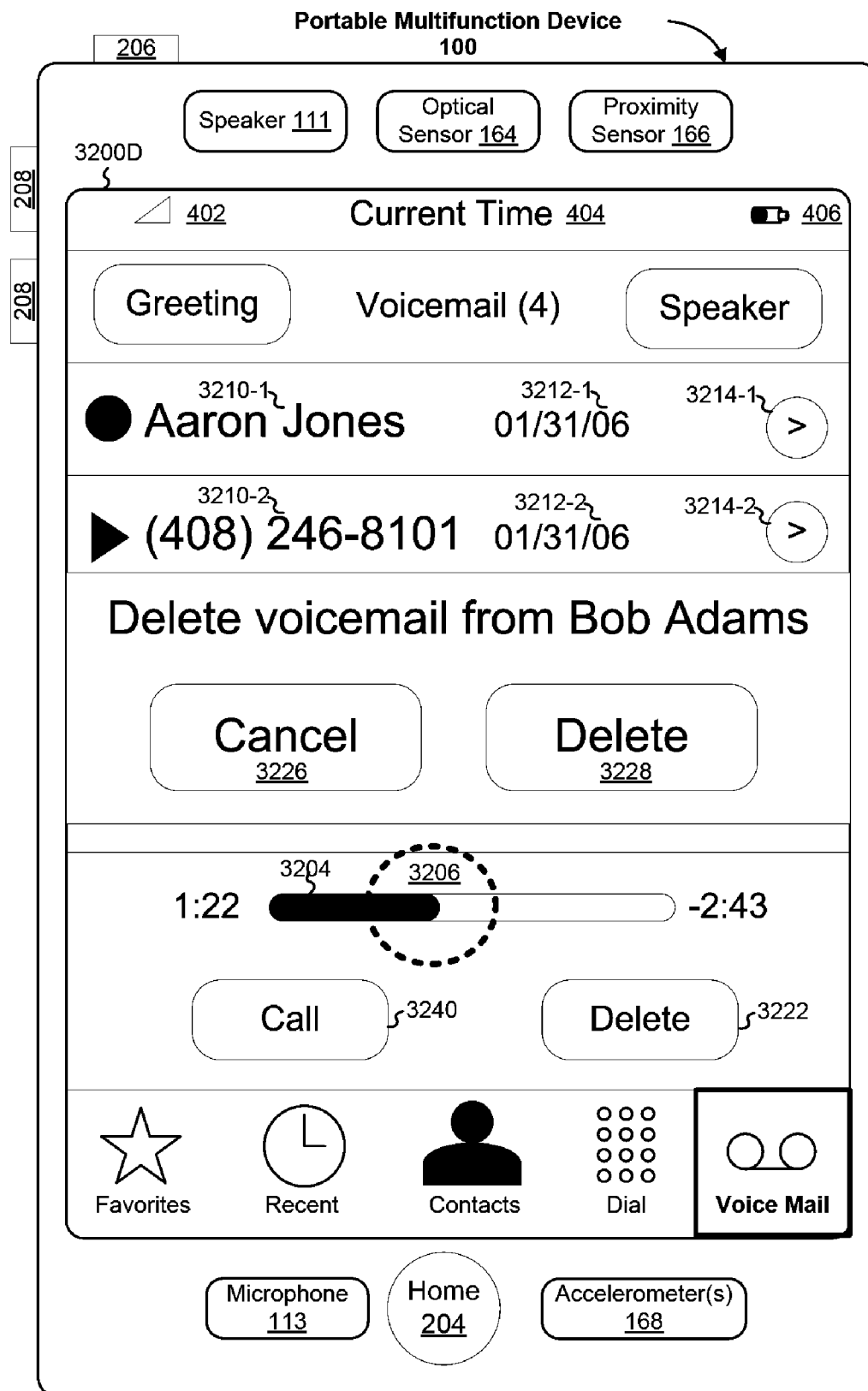


Figure 32D

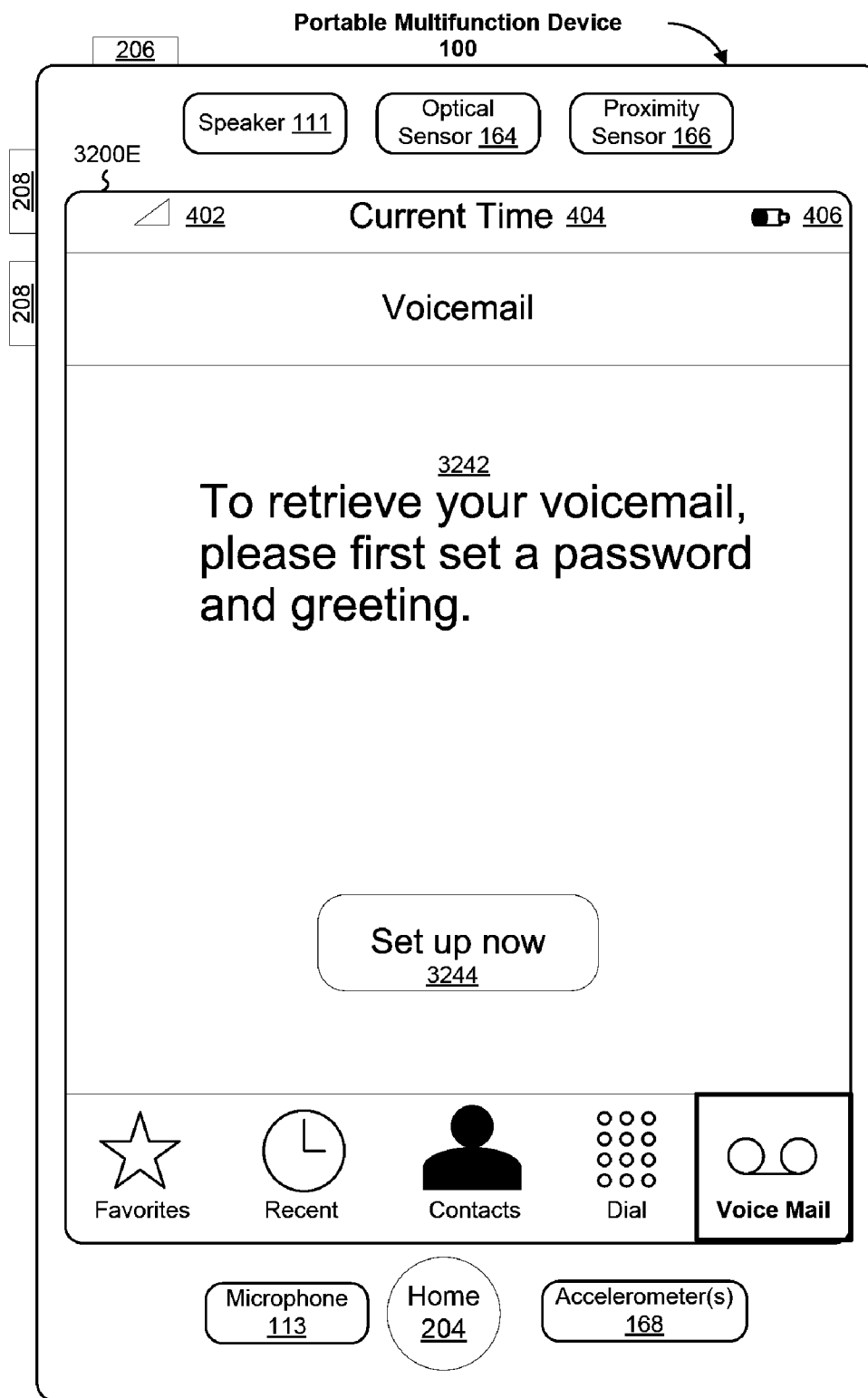


Figure 32E

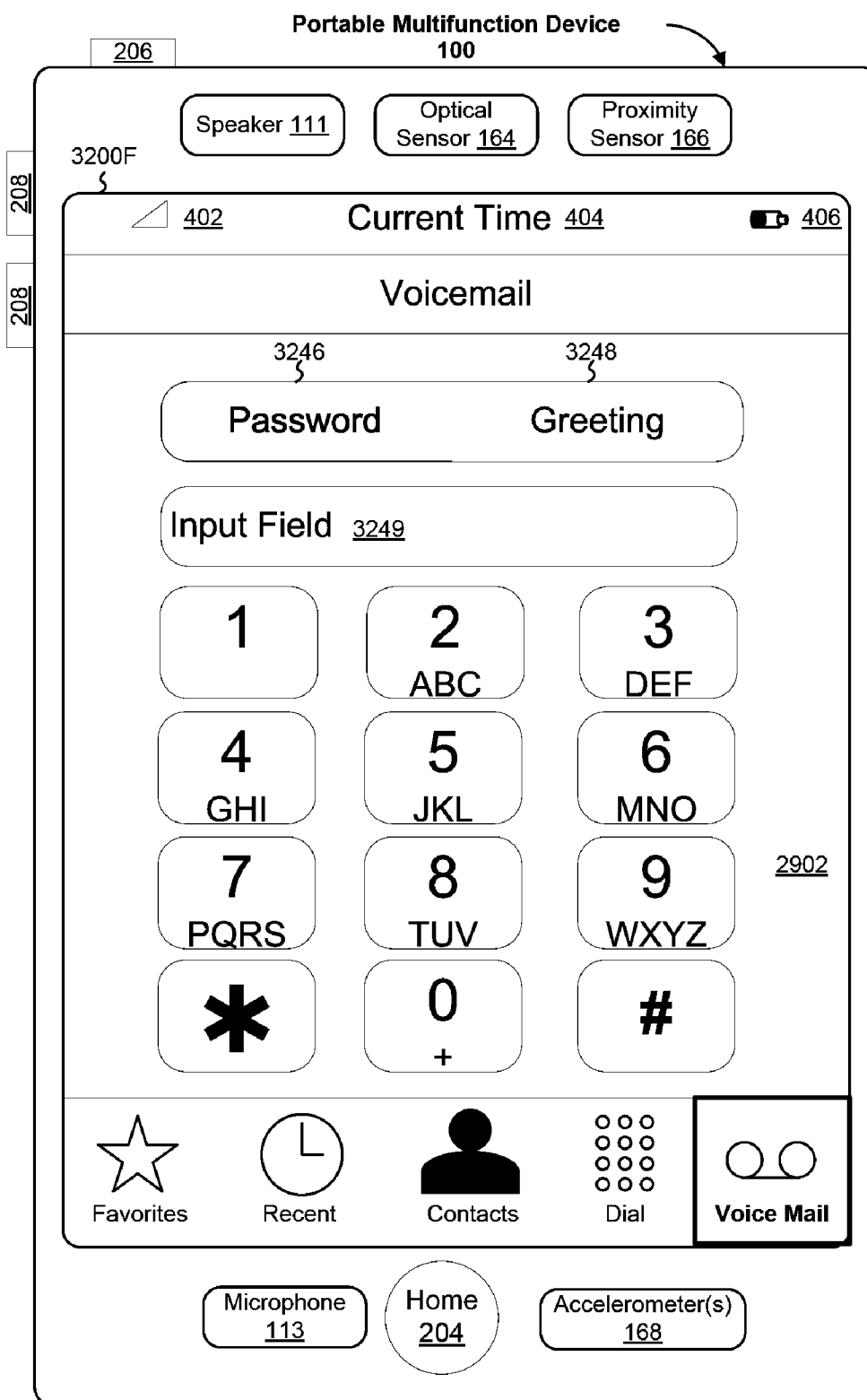


Figure 32F

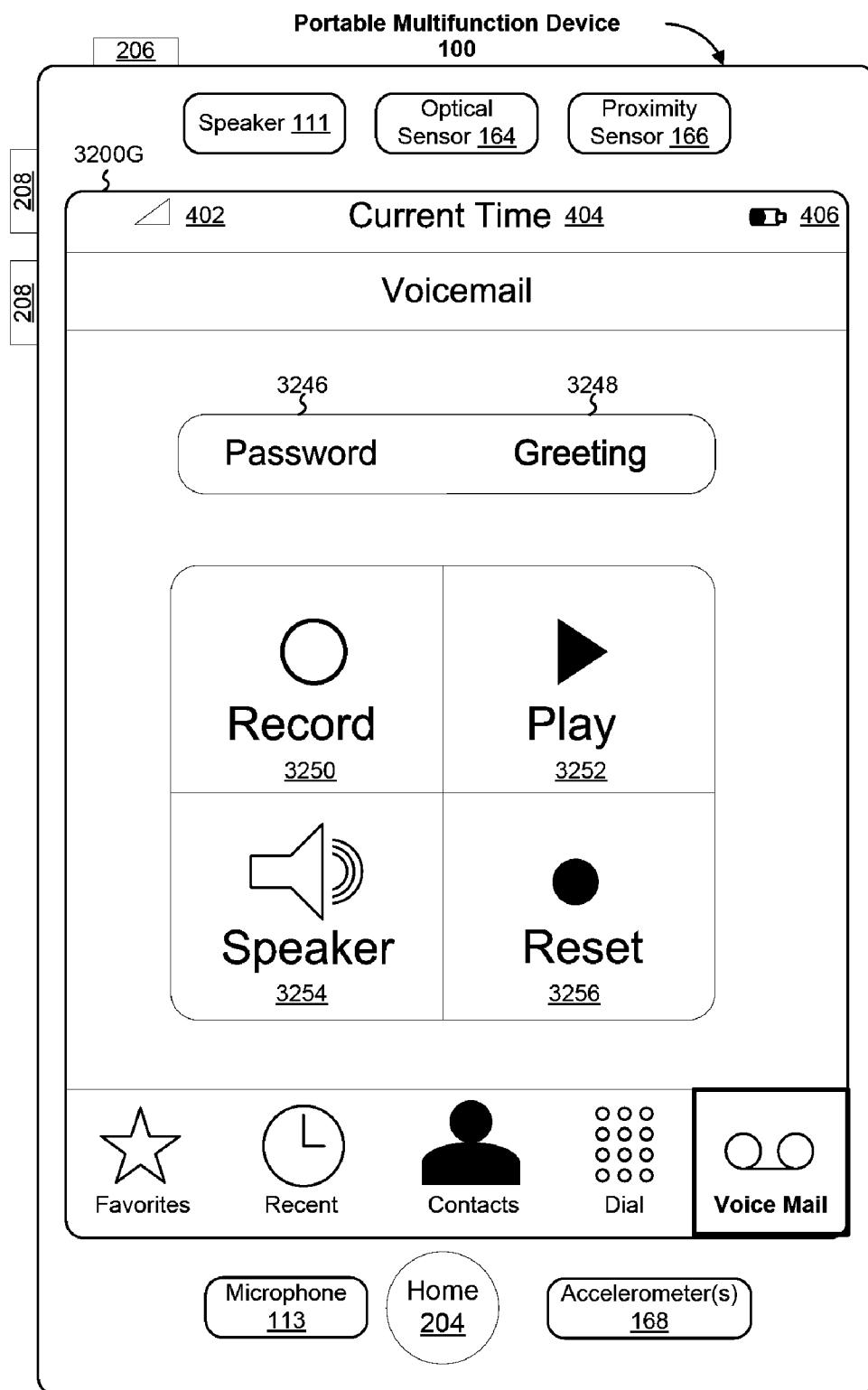


Figure 32G

U.S. Patent

Jan. 20, 2009

Sheet 123 of 293

US 7,479,949 B2

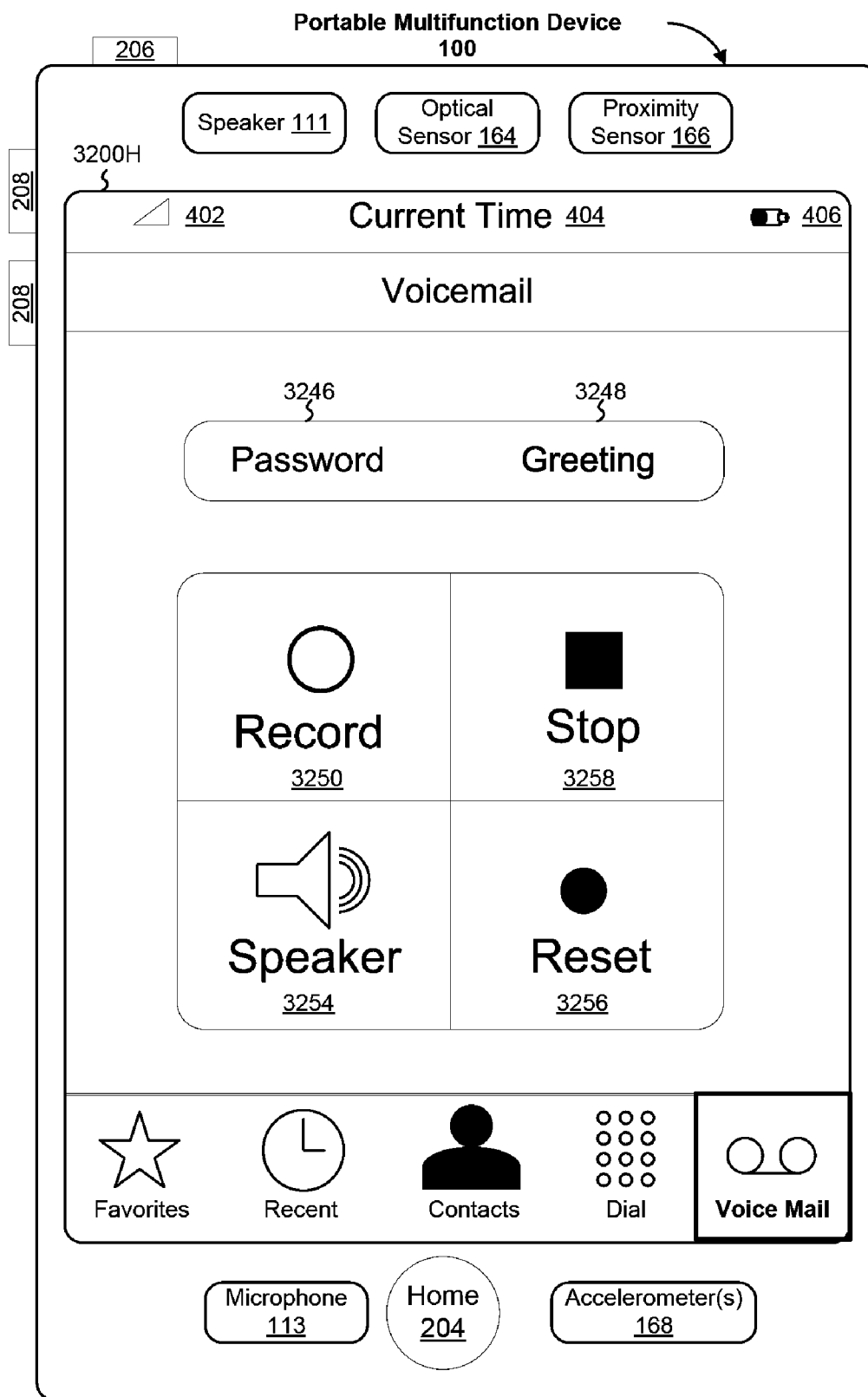


Figure 32H

U.S. Patent

Jan. 20, 2009

Sheet 124 of 293

US 7,479,949 B2



Figure 33

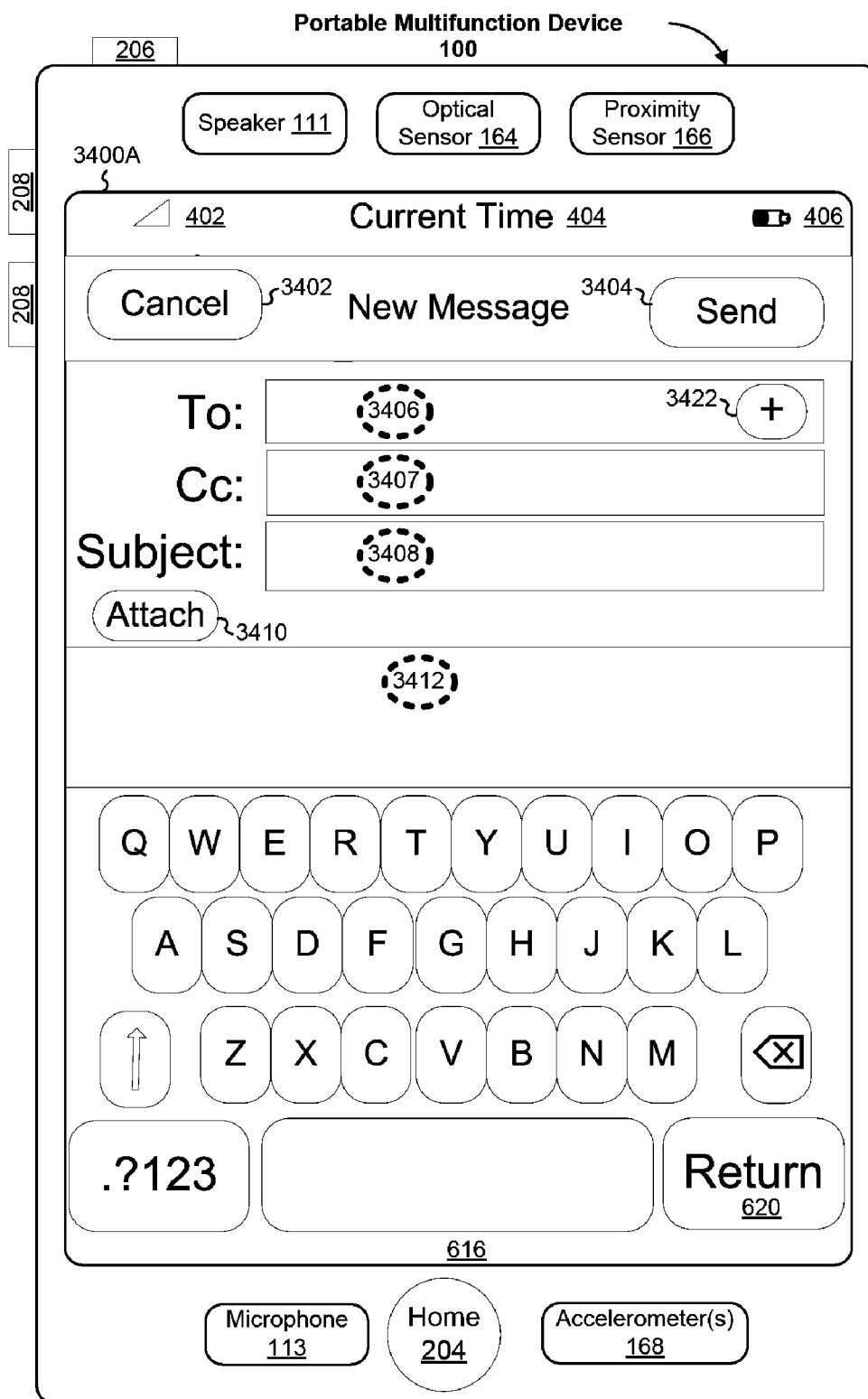


Figure 34A

U.S. Patent

Jan. 20, 2009

Sheet 126 of 293

US 7,479,949 B2

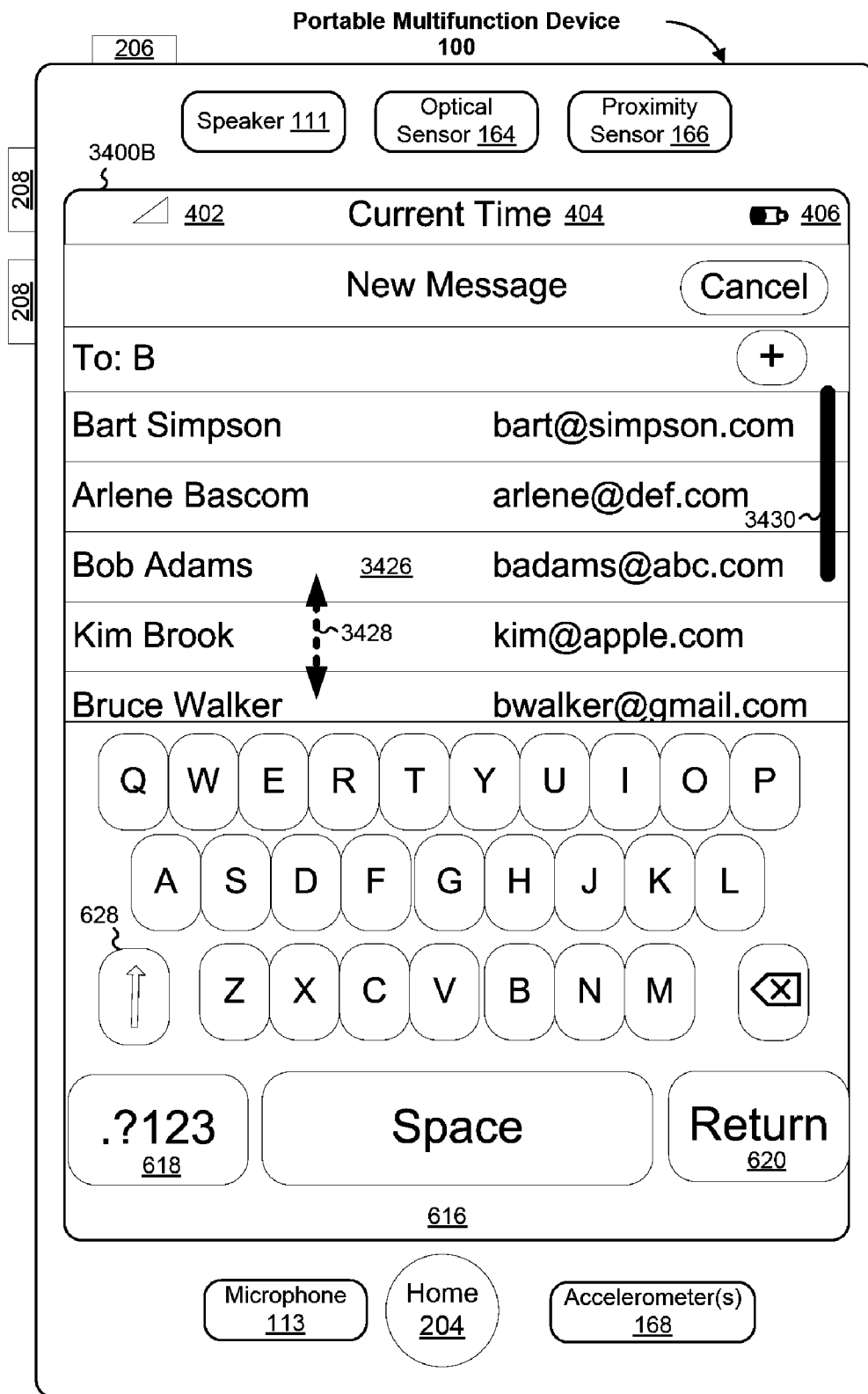


Figure 34B

U.S. Patent

Jan. 20, 2009

Sheet 127 of 293

US 7,479,949 B2

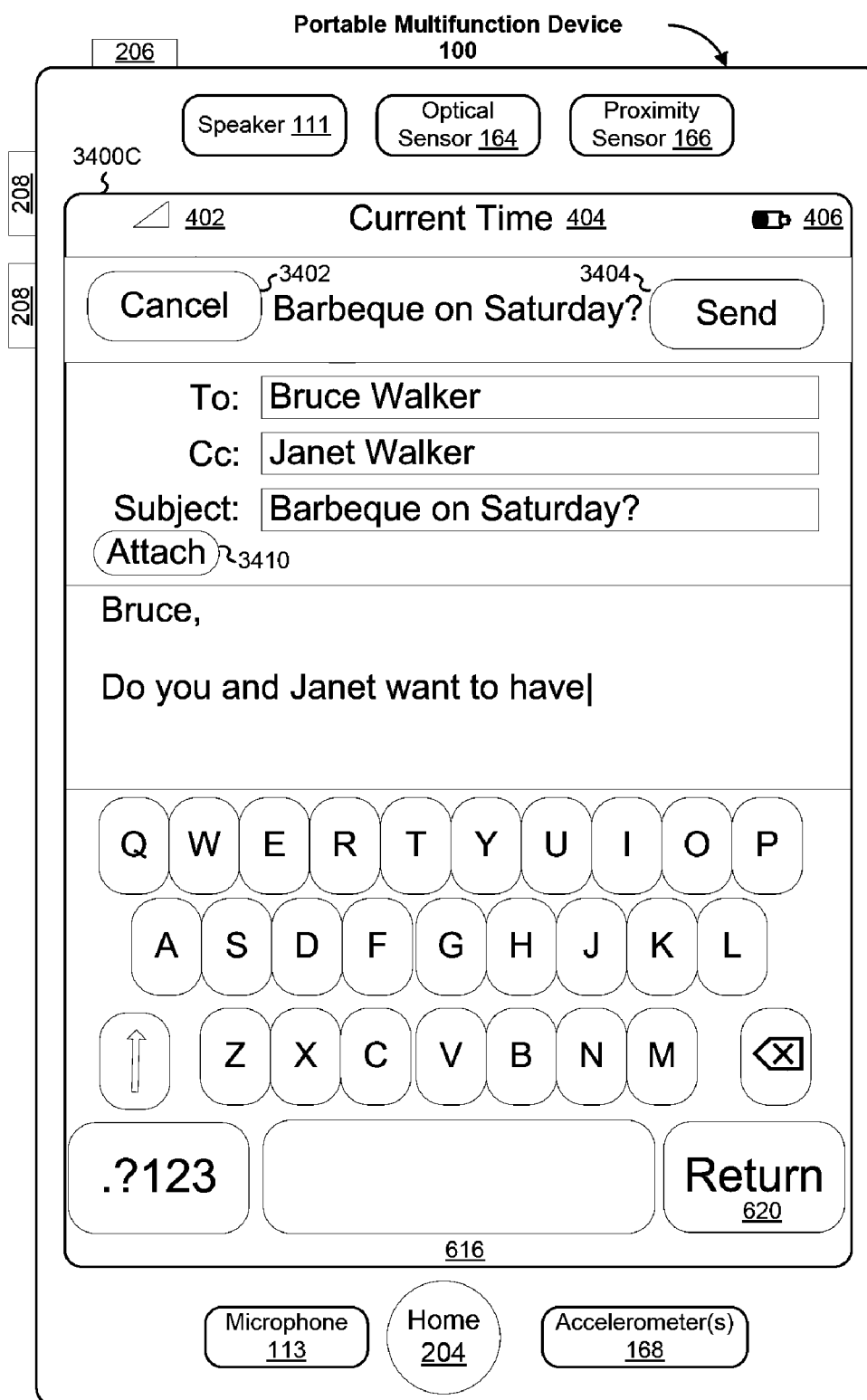


Figure 34C

U.S. Patent

Jan. 20, 2009

Sheet 128 of 293

US 7,479,949 B2

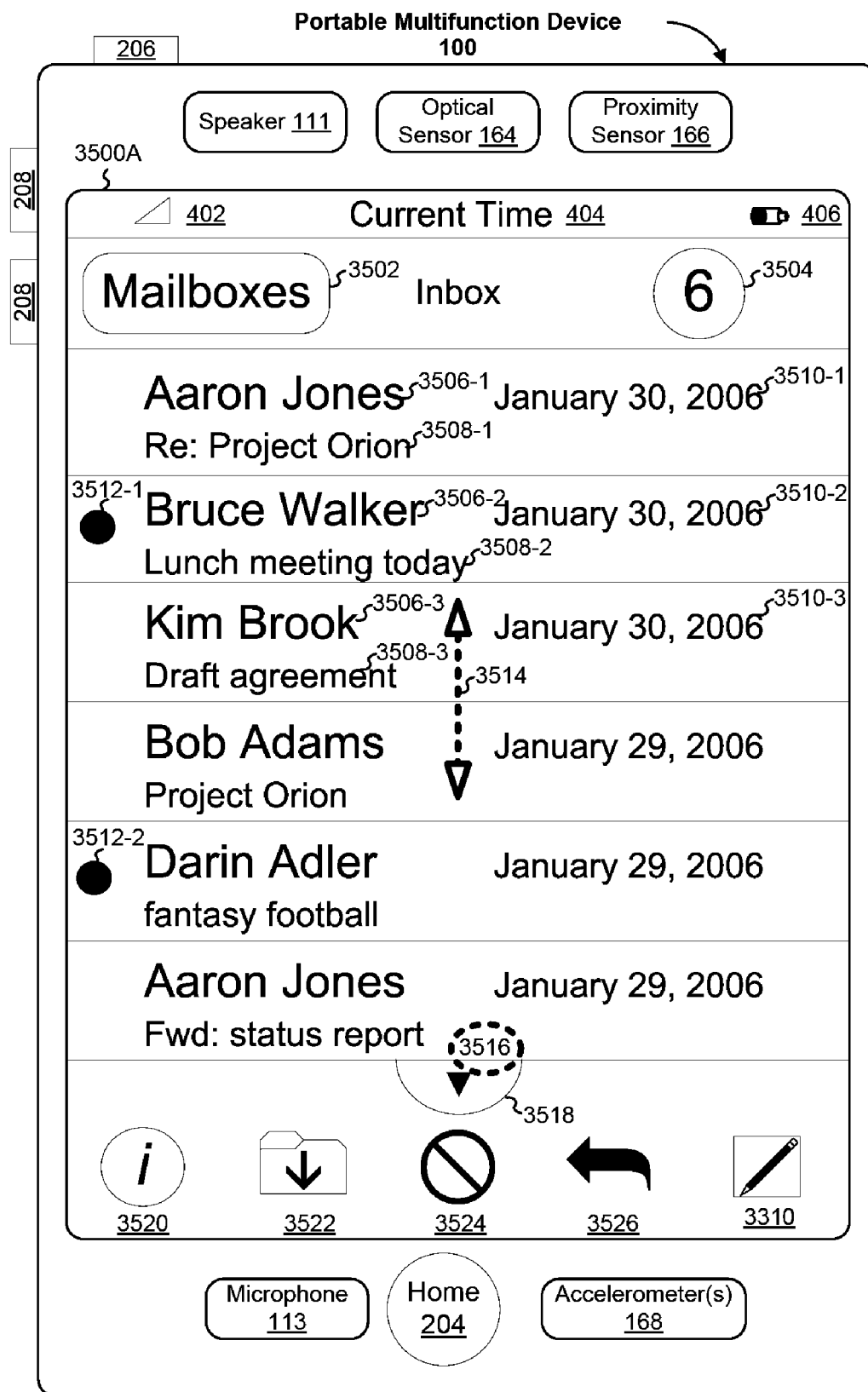


Figure 35A

U.S. Patent

Jan. 20, 2009

Sheet 129 of 293

US 7,479,949 B2

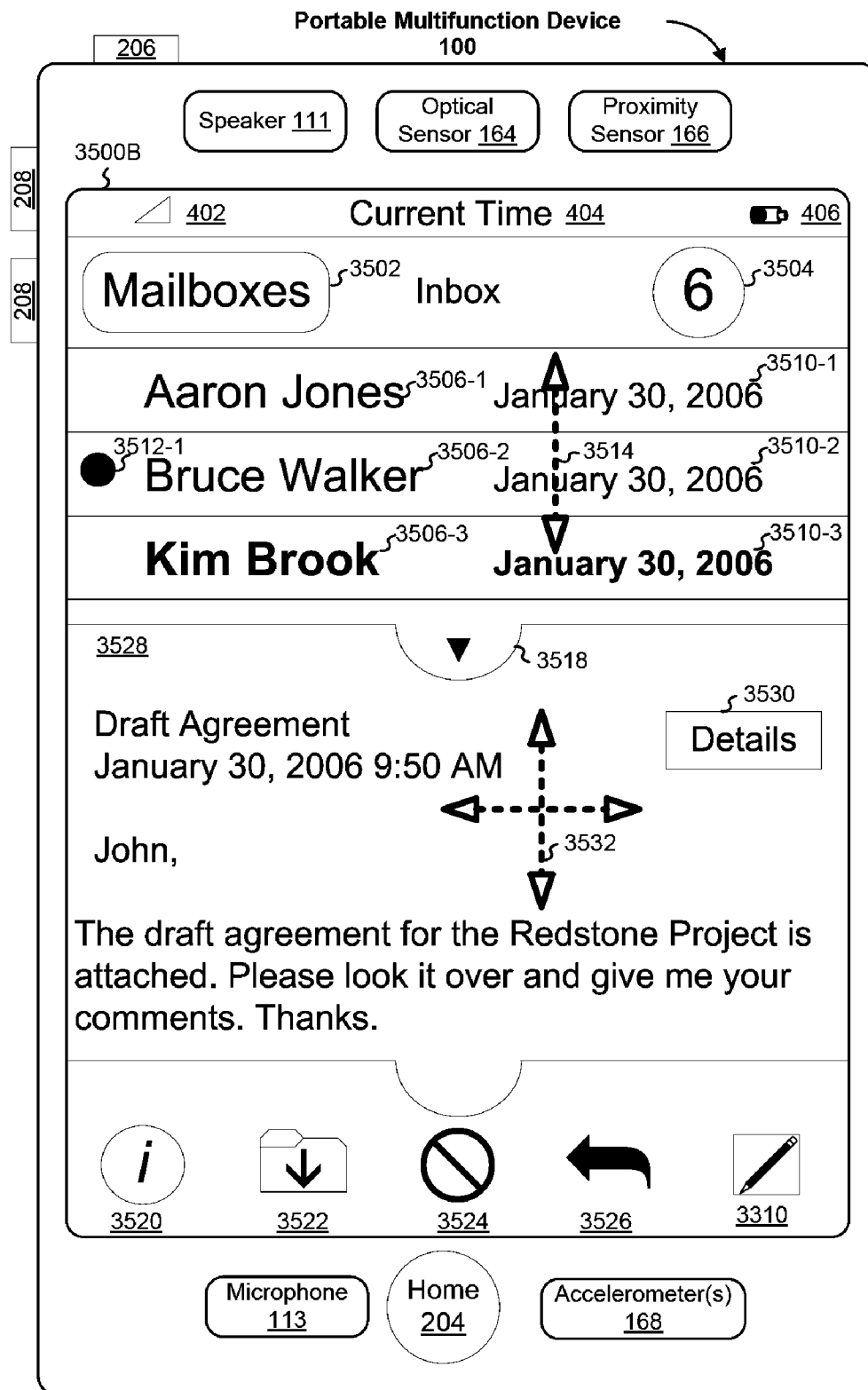


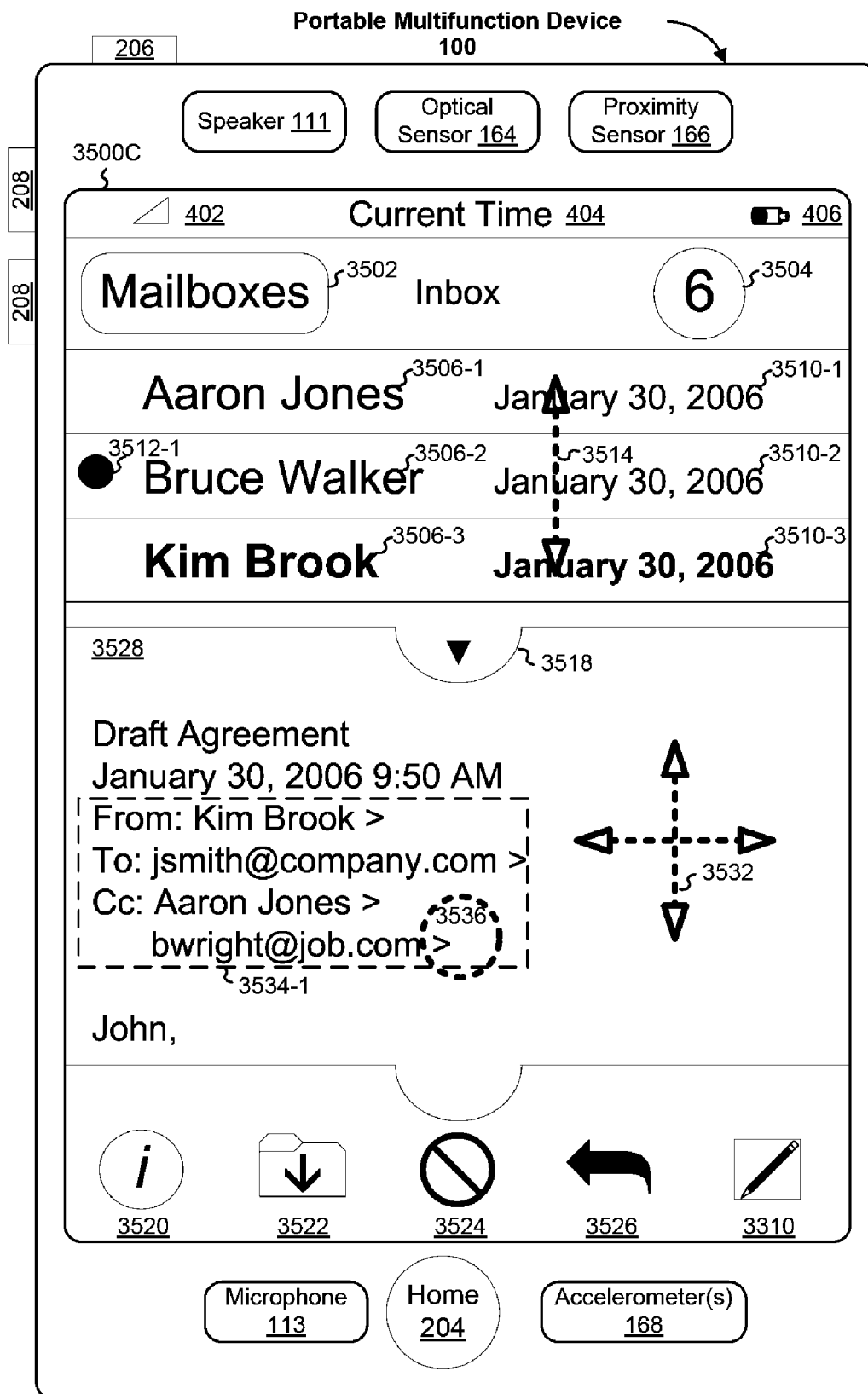
Figure 35B

U.S. Patent

Jan. 20, 2009

Sheet 130 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 131 of 293

US 7,479,949 B2

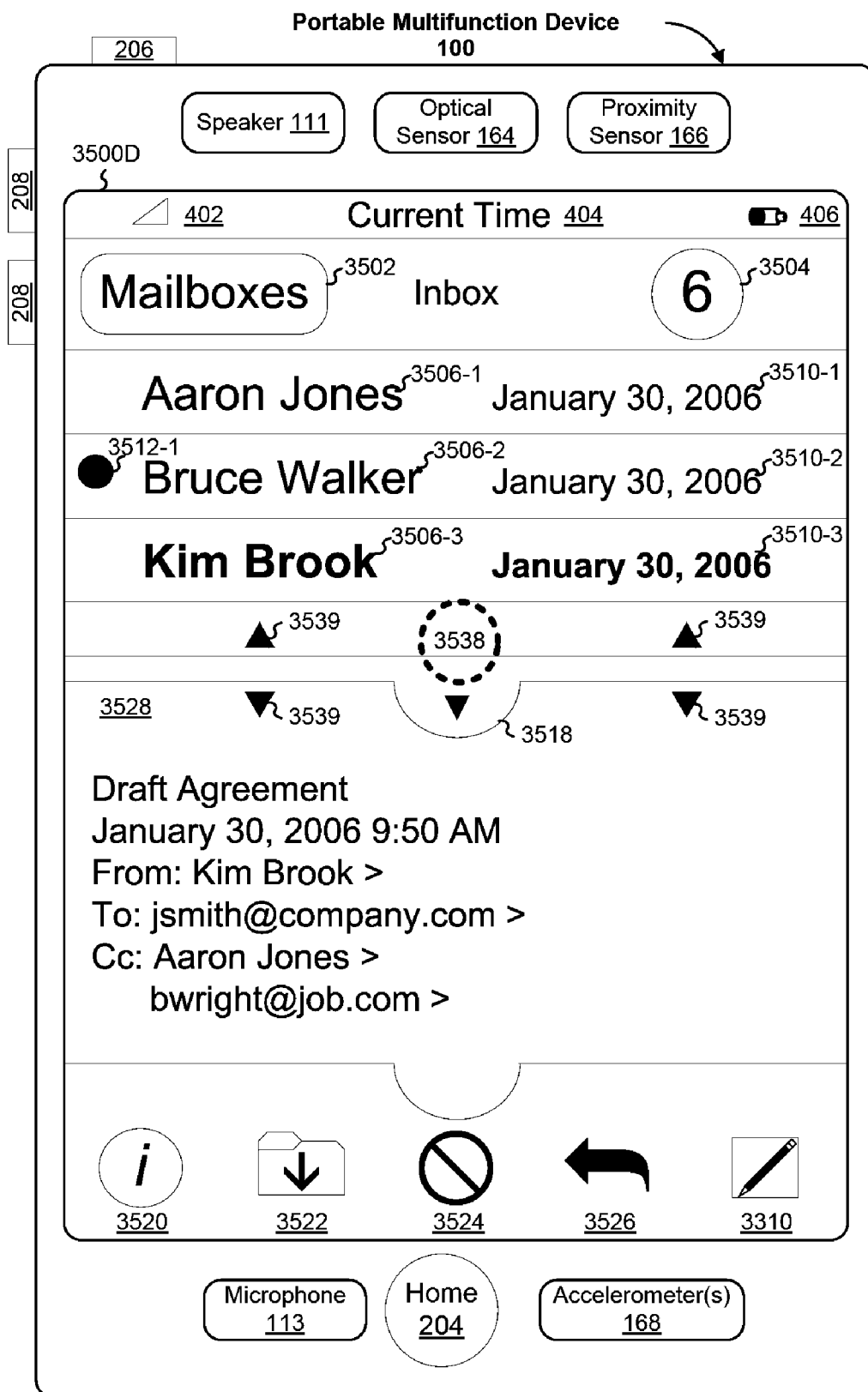


Figure 35D

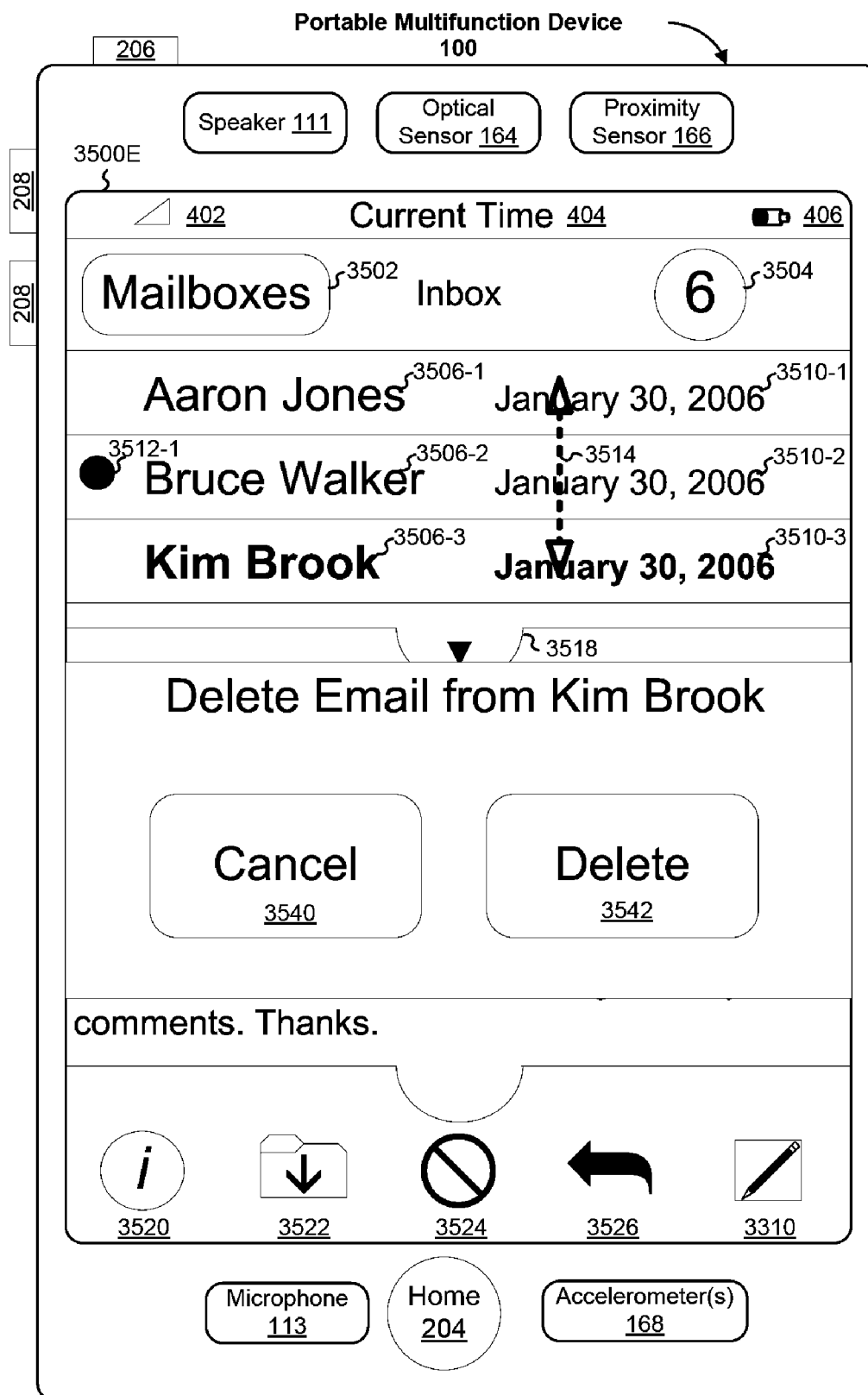


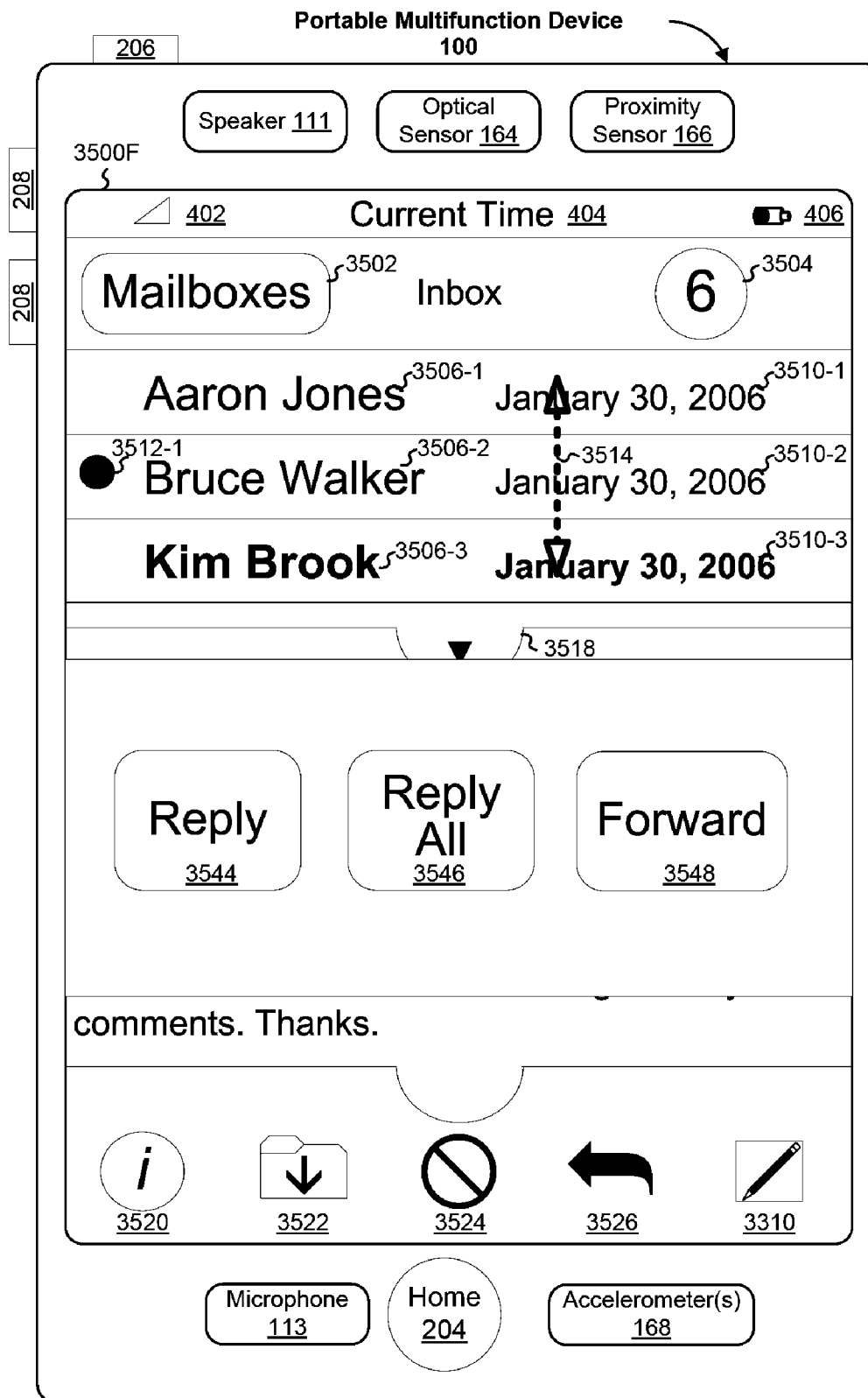
Figure 35E

U.S. Patent

Jan. 20, 2009

Sheet 133 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 134 of 293

US 7,479,949 B2

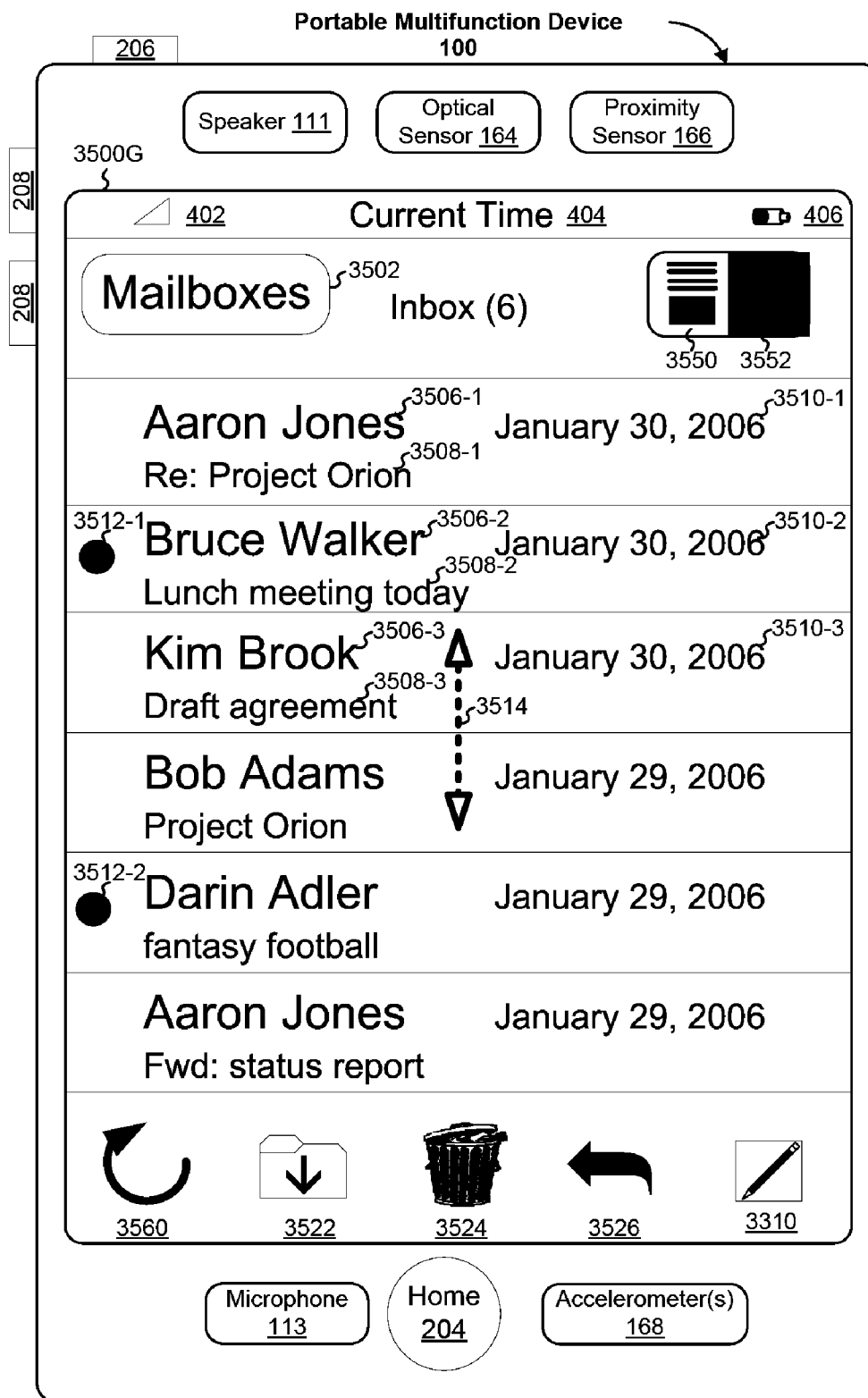


Figure 35G

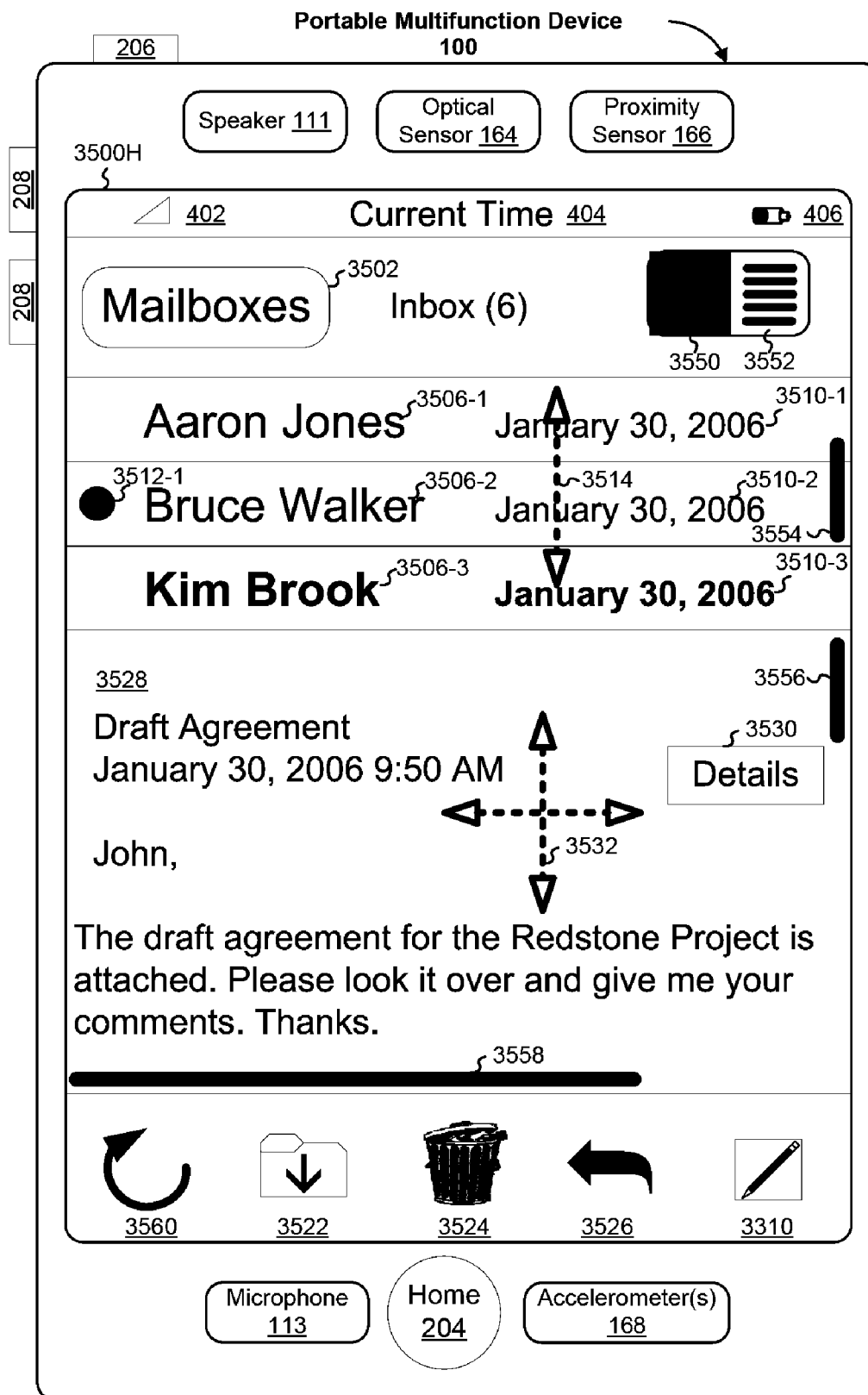


Figure 35H

U.S. Patent

Jan. 20, 2009

Sheet 136 of 293

US 7,479,949 B2

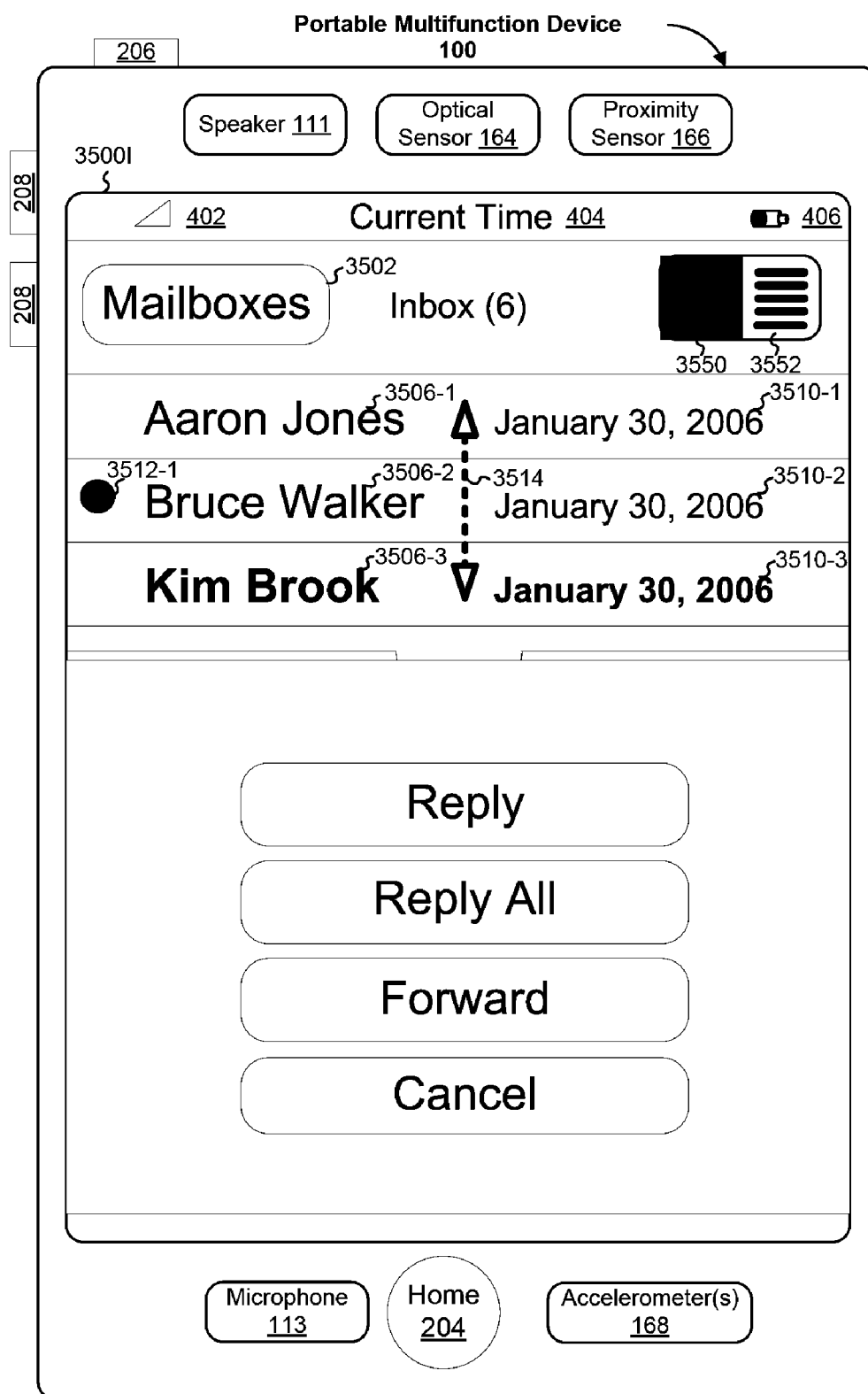


Figure 35I

U.S. Patent

Jan. 20, 2009

Sheet 137 of 293

US 7,479,949 B2



Figure 35J



Figure 35K

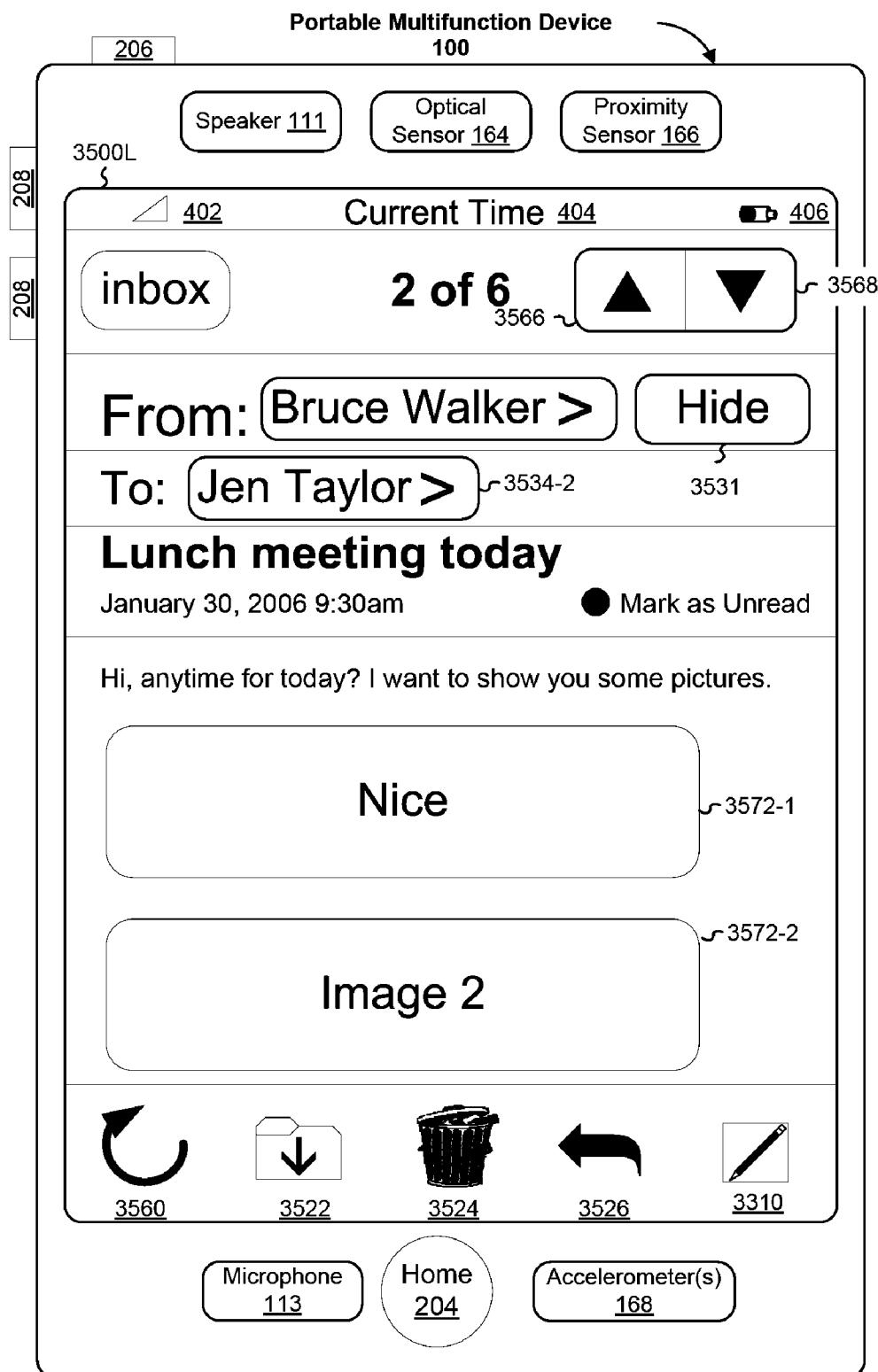


Figure 35L

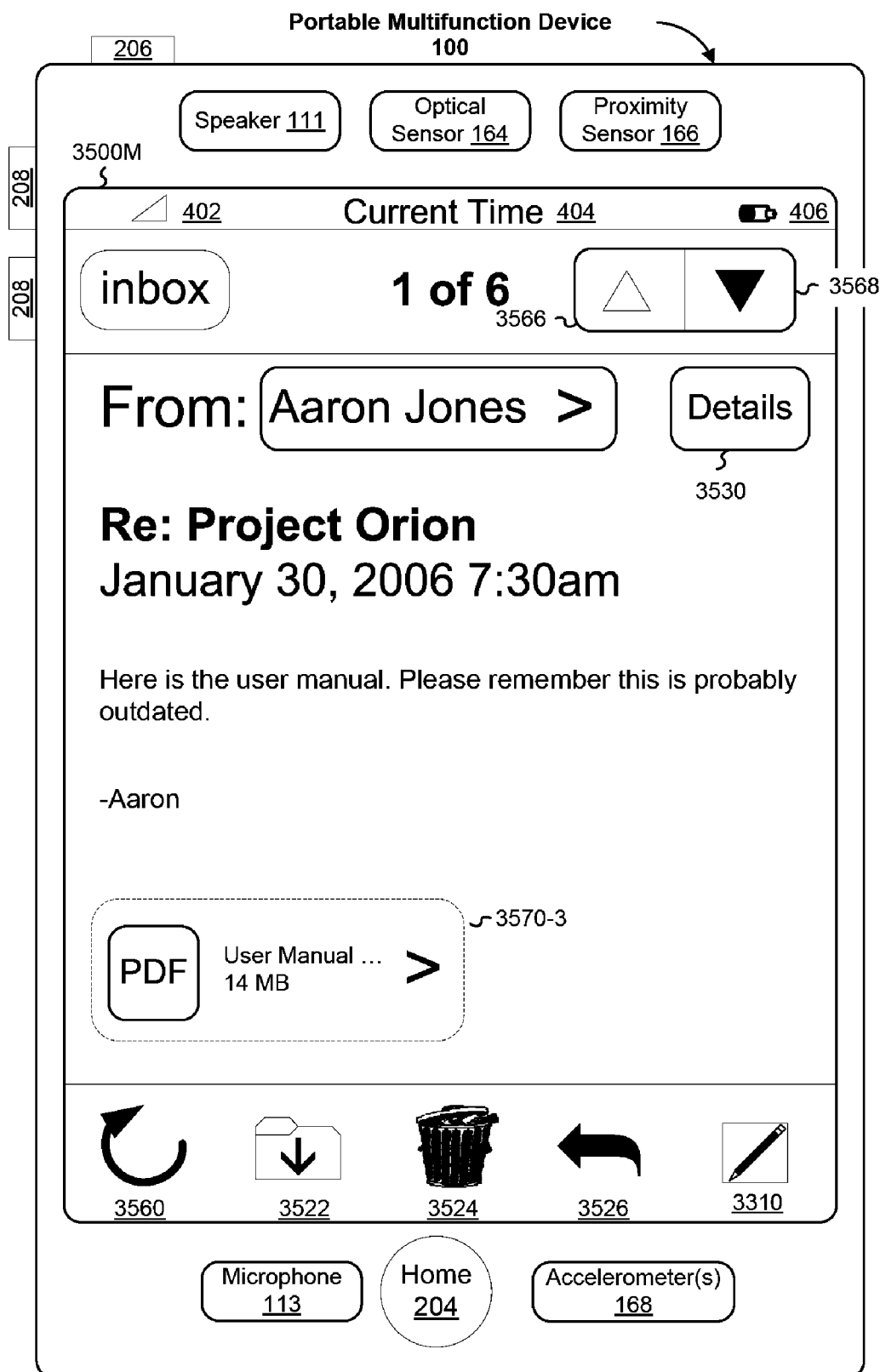


Figure 35M

U.S. Patent

Jan. 20, 2009

Sheet 141 of 293

US 7,479,949 B2

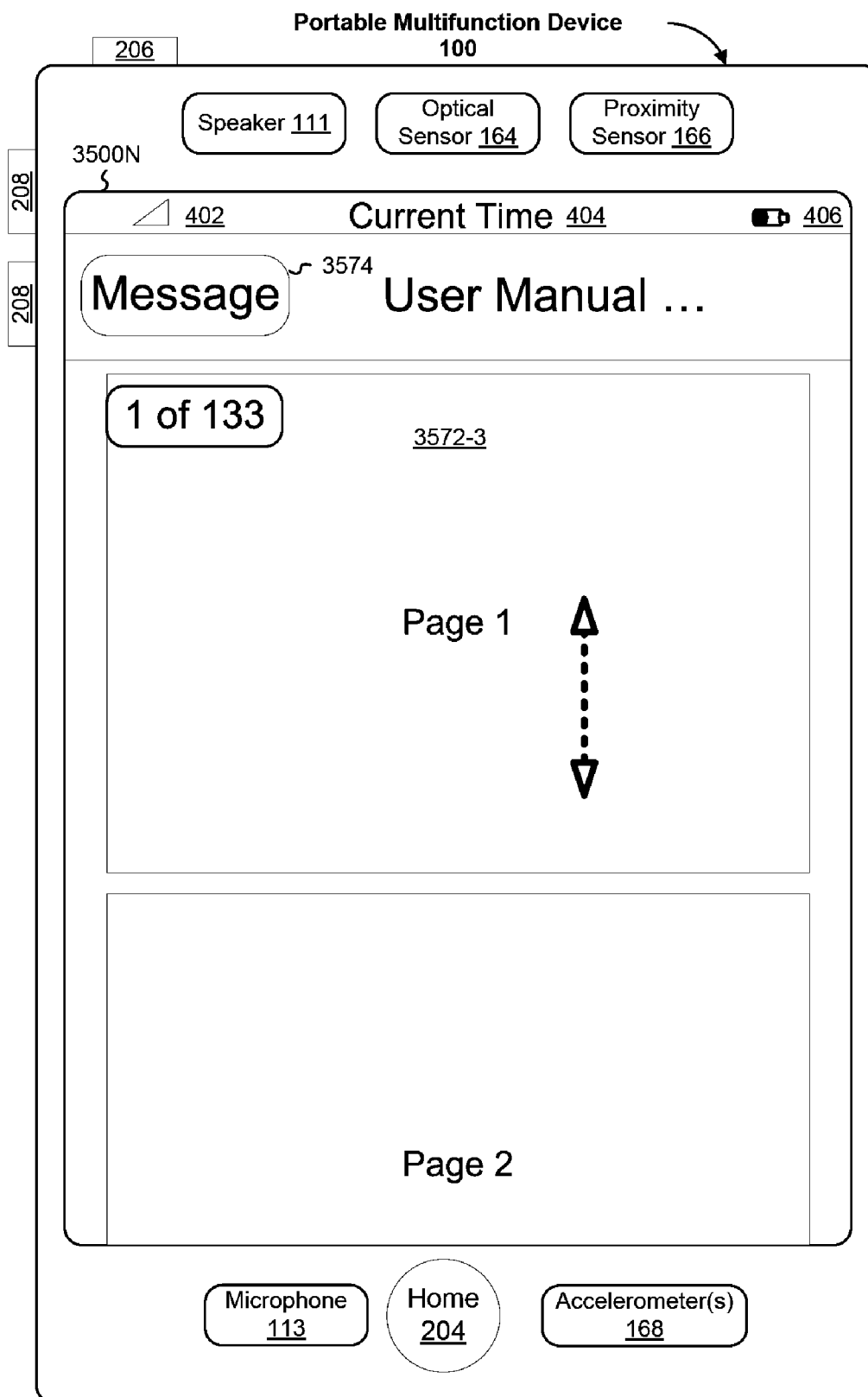


Figure 35N

U.S. Patent

Jan. 20, 2009

Sheet 142 of 293

US 7,479,949 B2

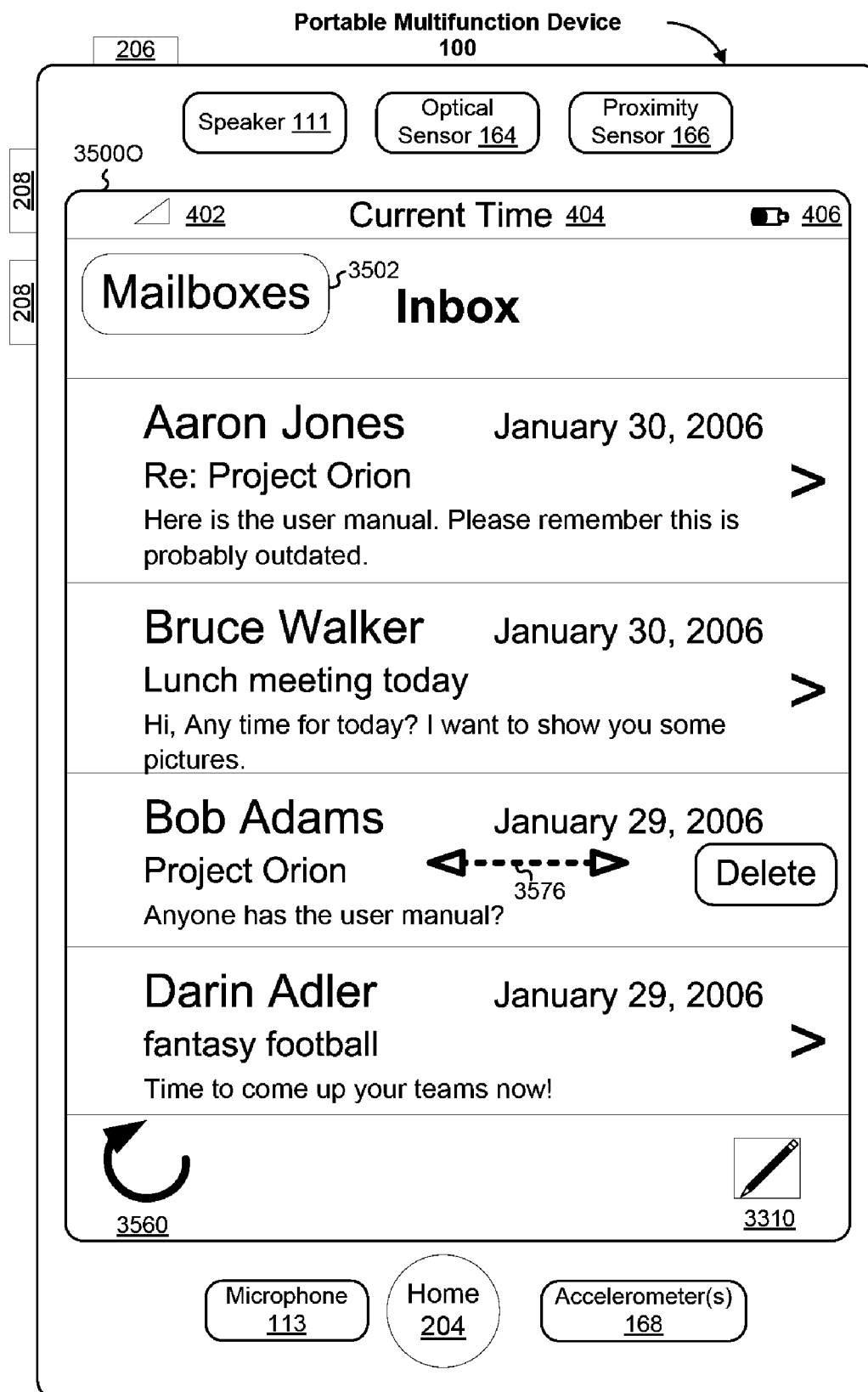


Figure 350

U.S. Patent

Jan. 20, 2009

Sheet 143 of 293

US 7,479,949 B2

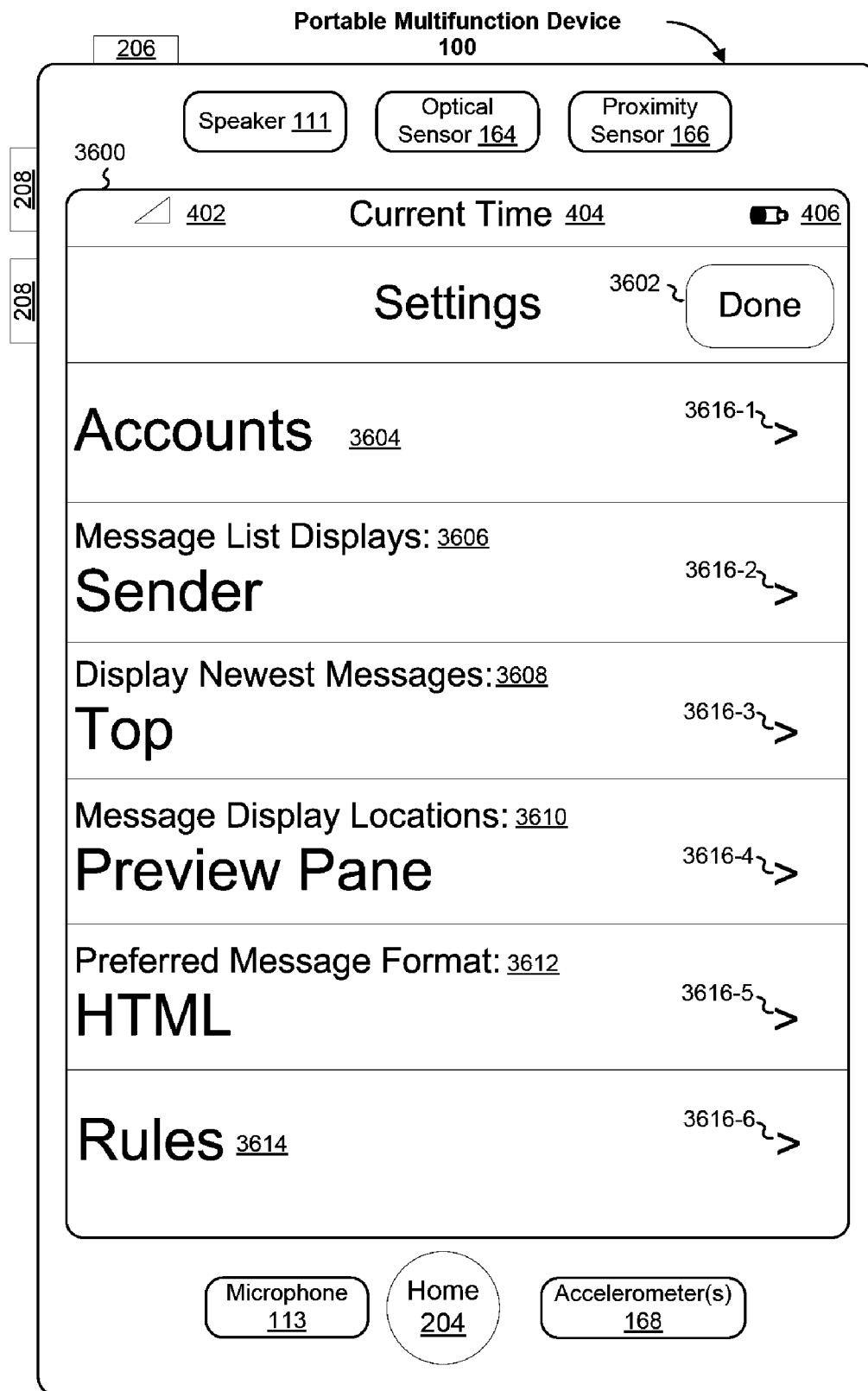


Figure 36

U.S. Patent

Jan. 20, 2009

Sheet 144 of 293

US 7,479,949 B2

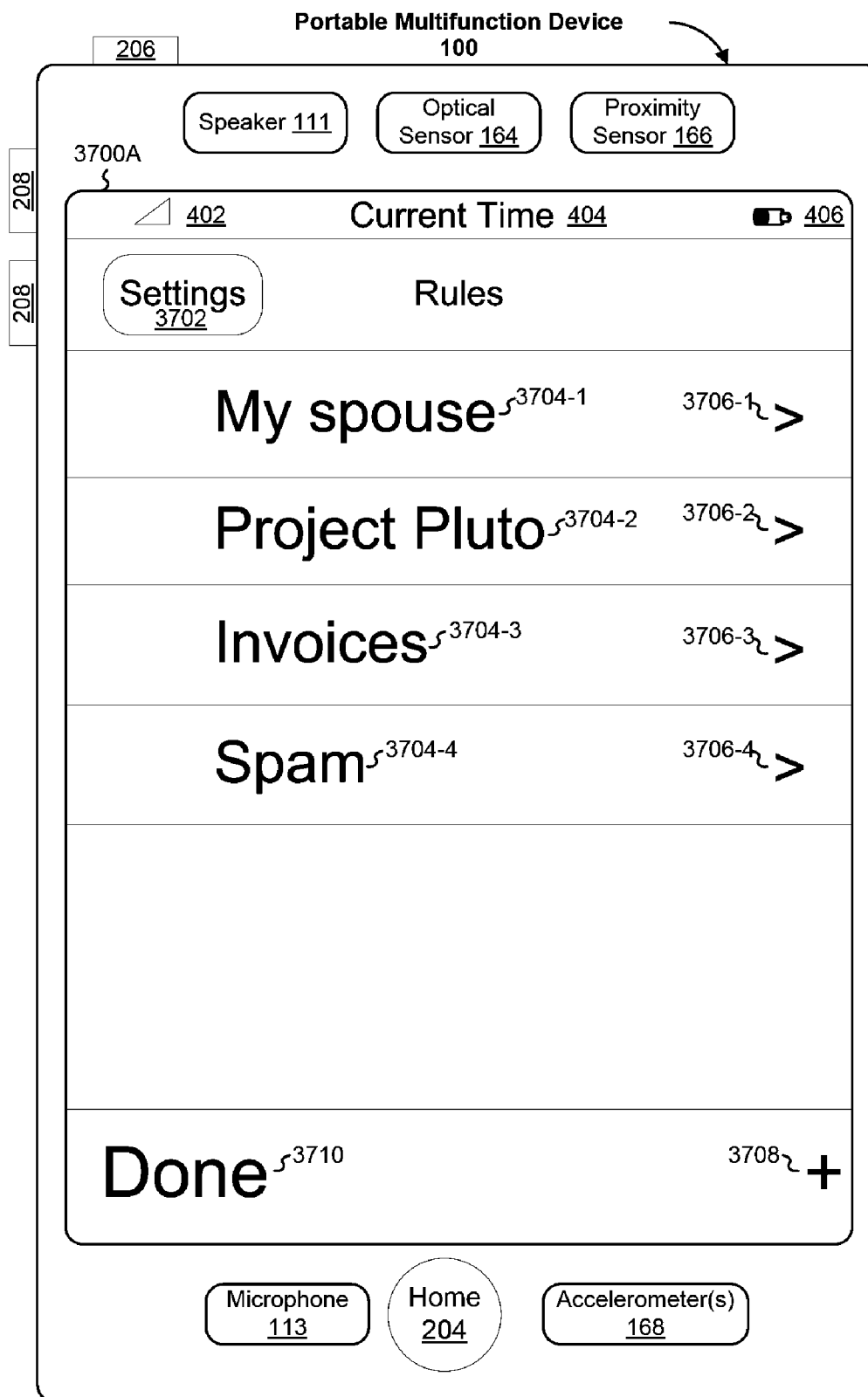


Figure 37A

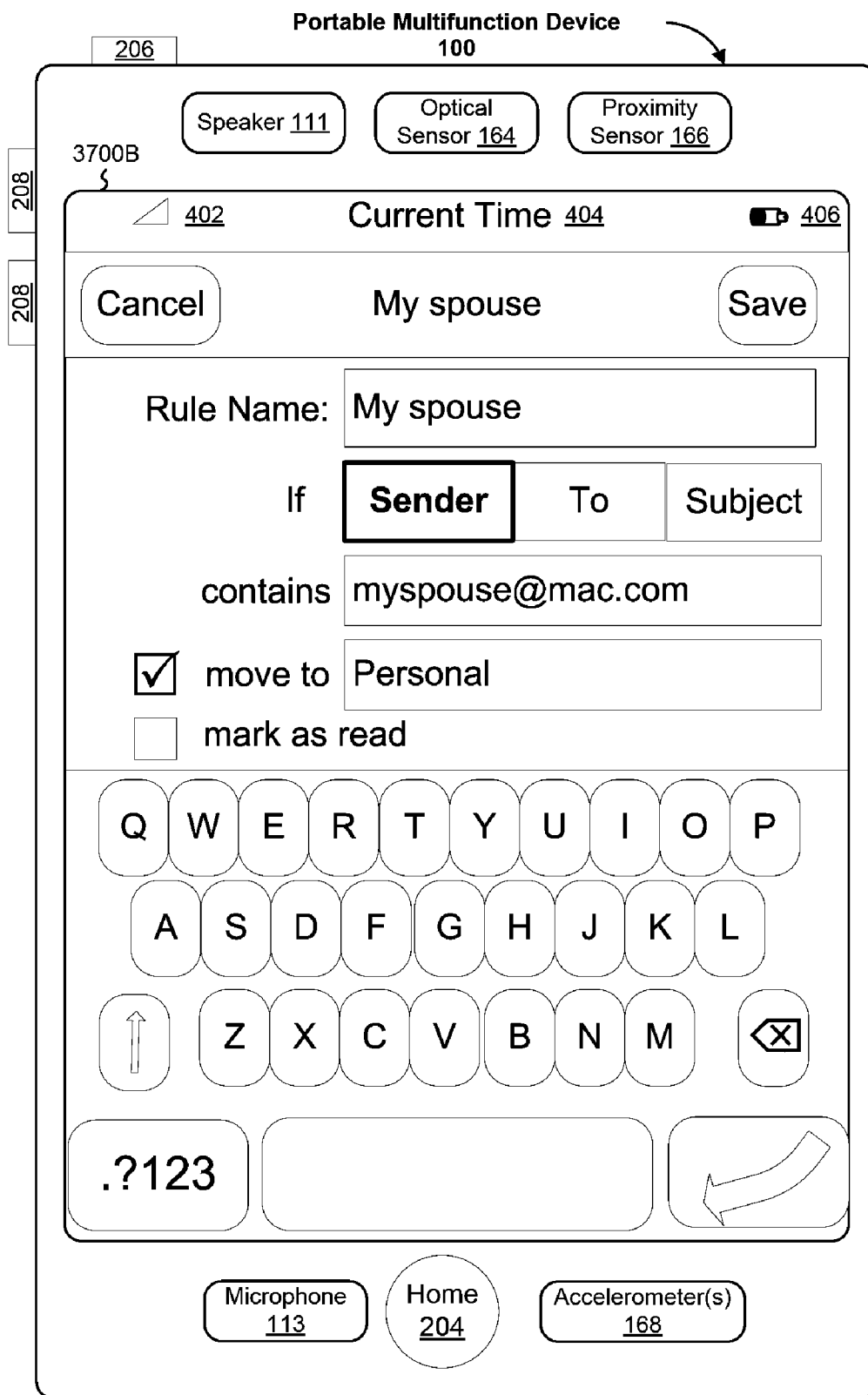


Figure 37B

U.S. Patent

Jan. 20, 2009

Sheet 146 of 293

US 7,479,949 B2

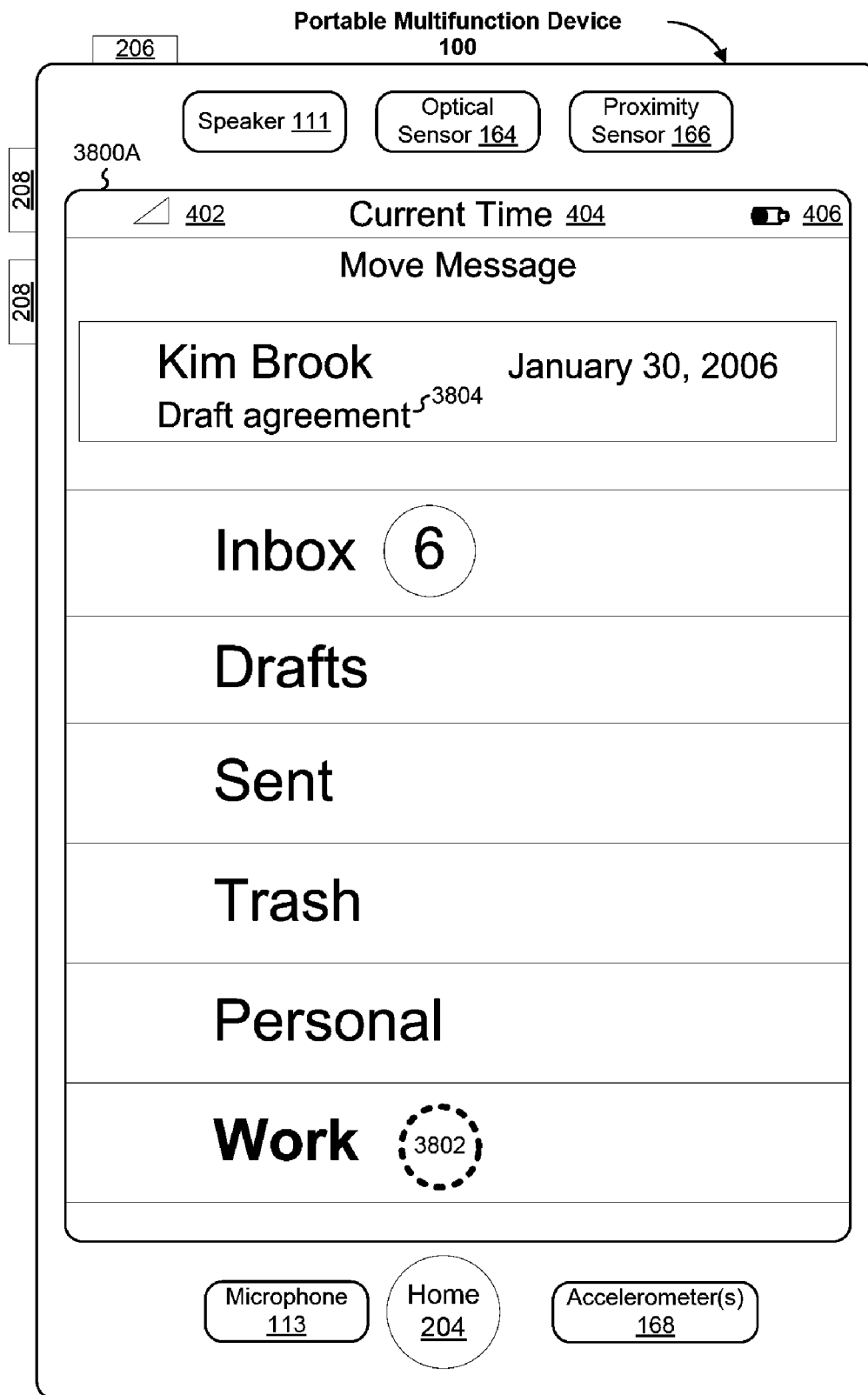


Figure 38A

U.S. Patent

Jan. 20, 2009

Sheet 147 of 293

US 7,479,949 B2

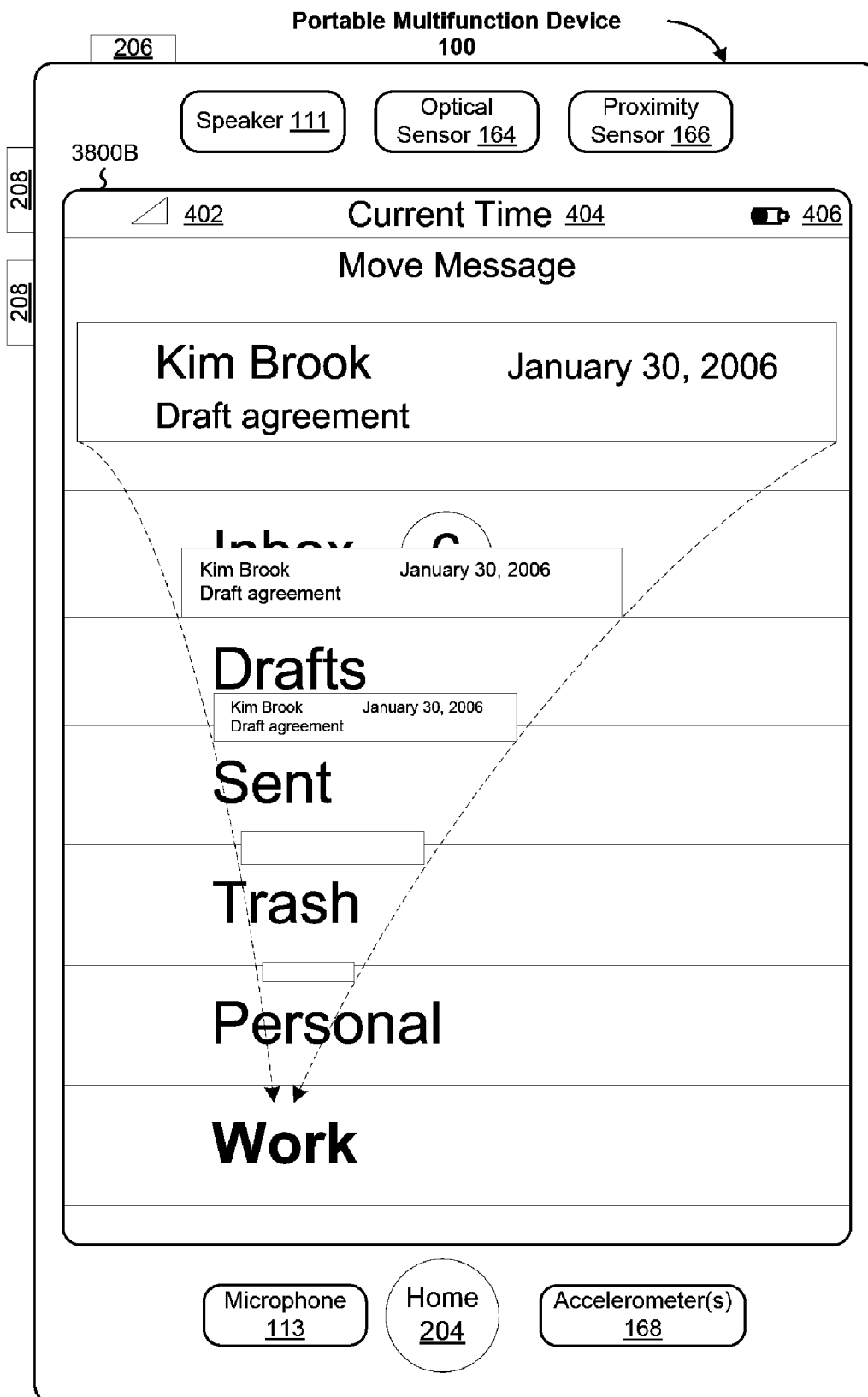


Figure 38B

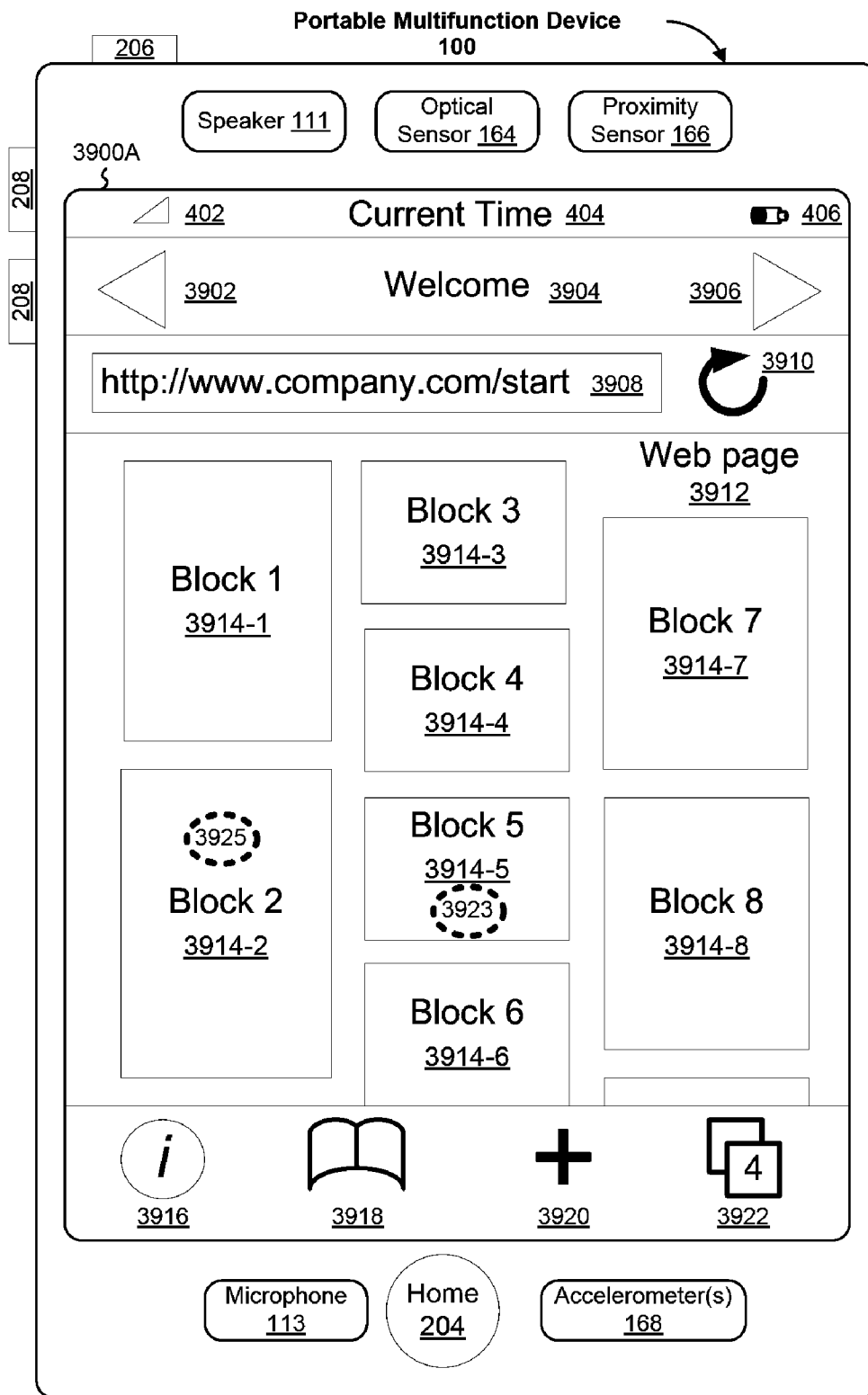


Figure 39A



Figure 39B

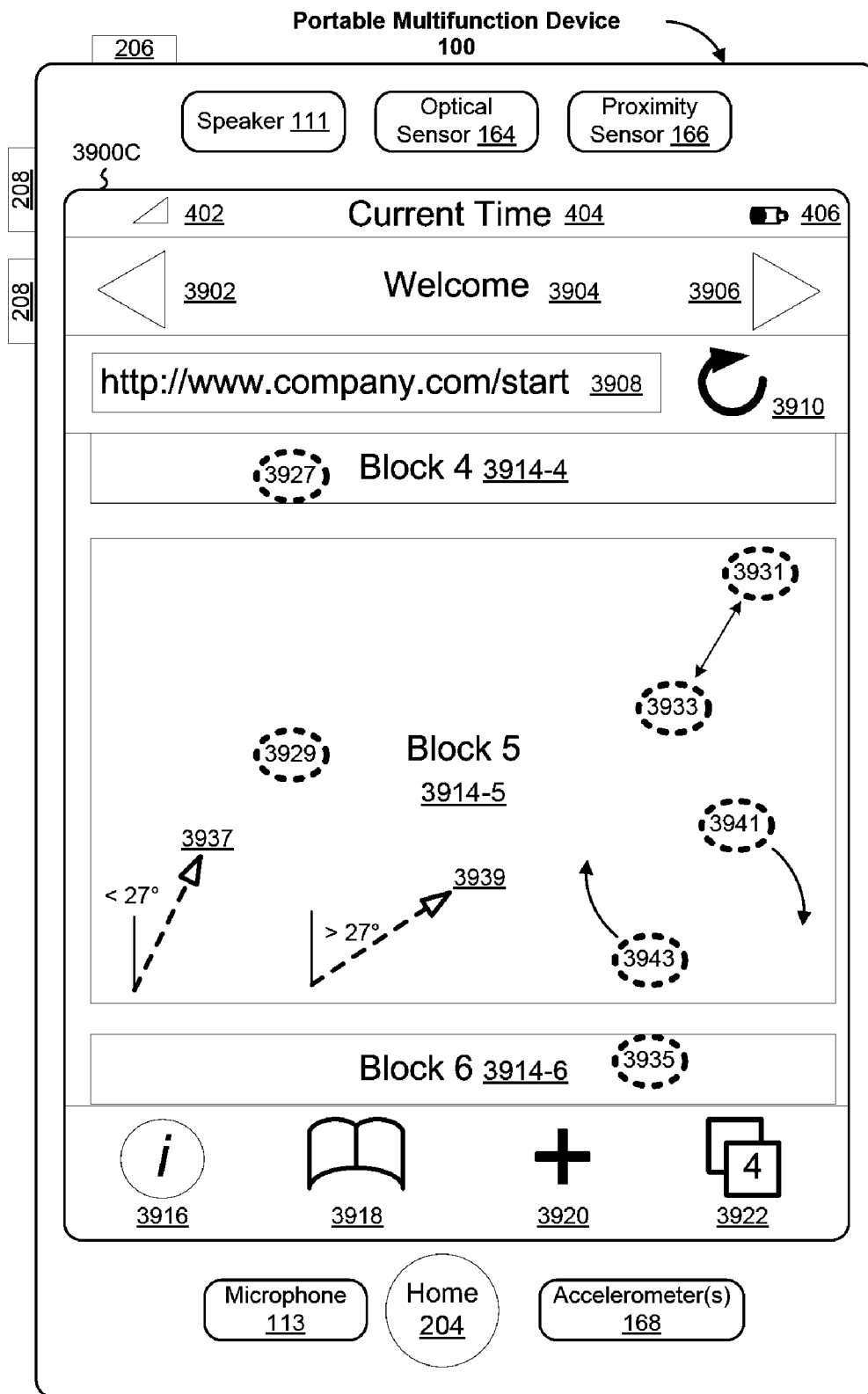


Figure 39C

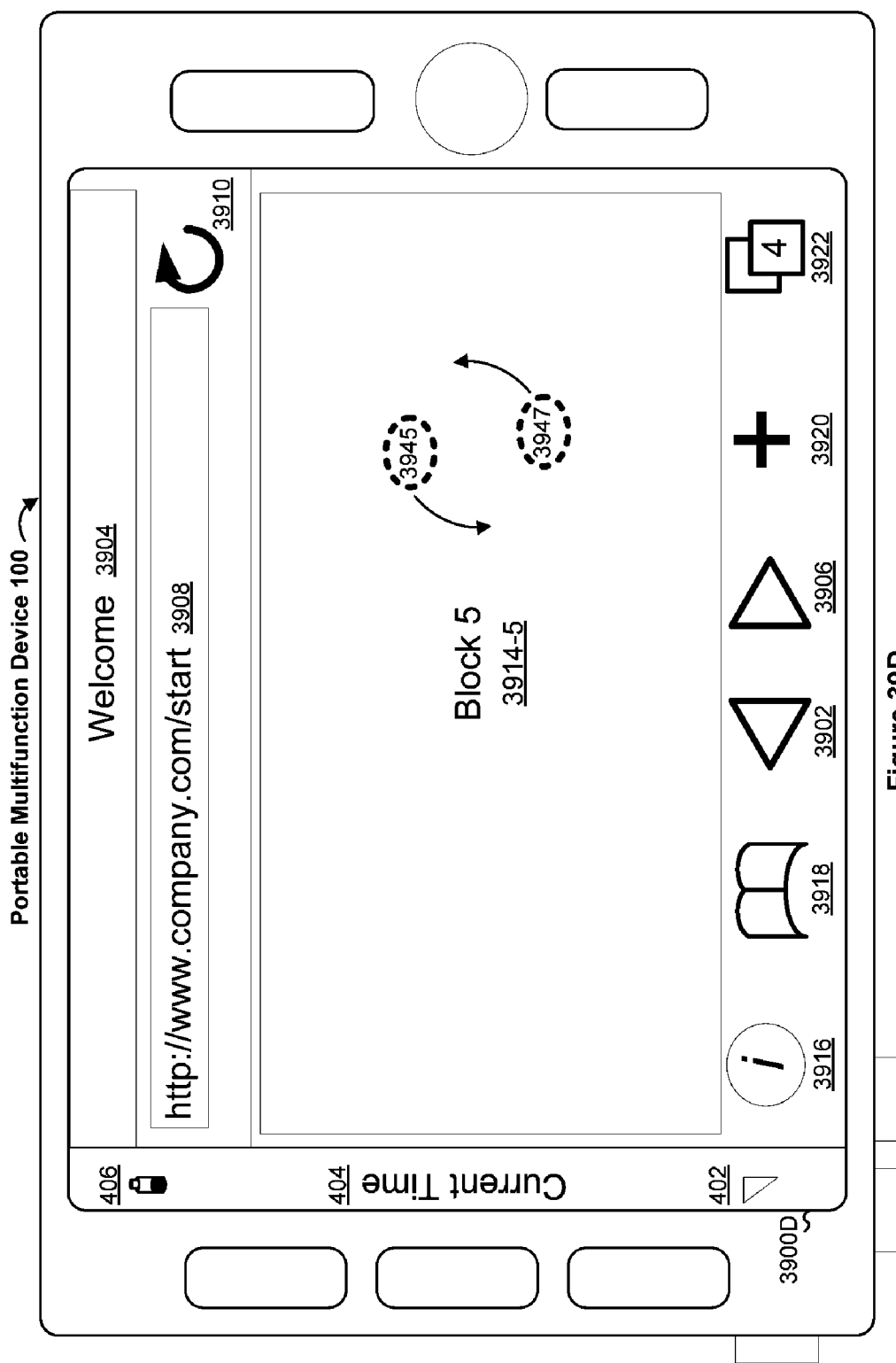
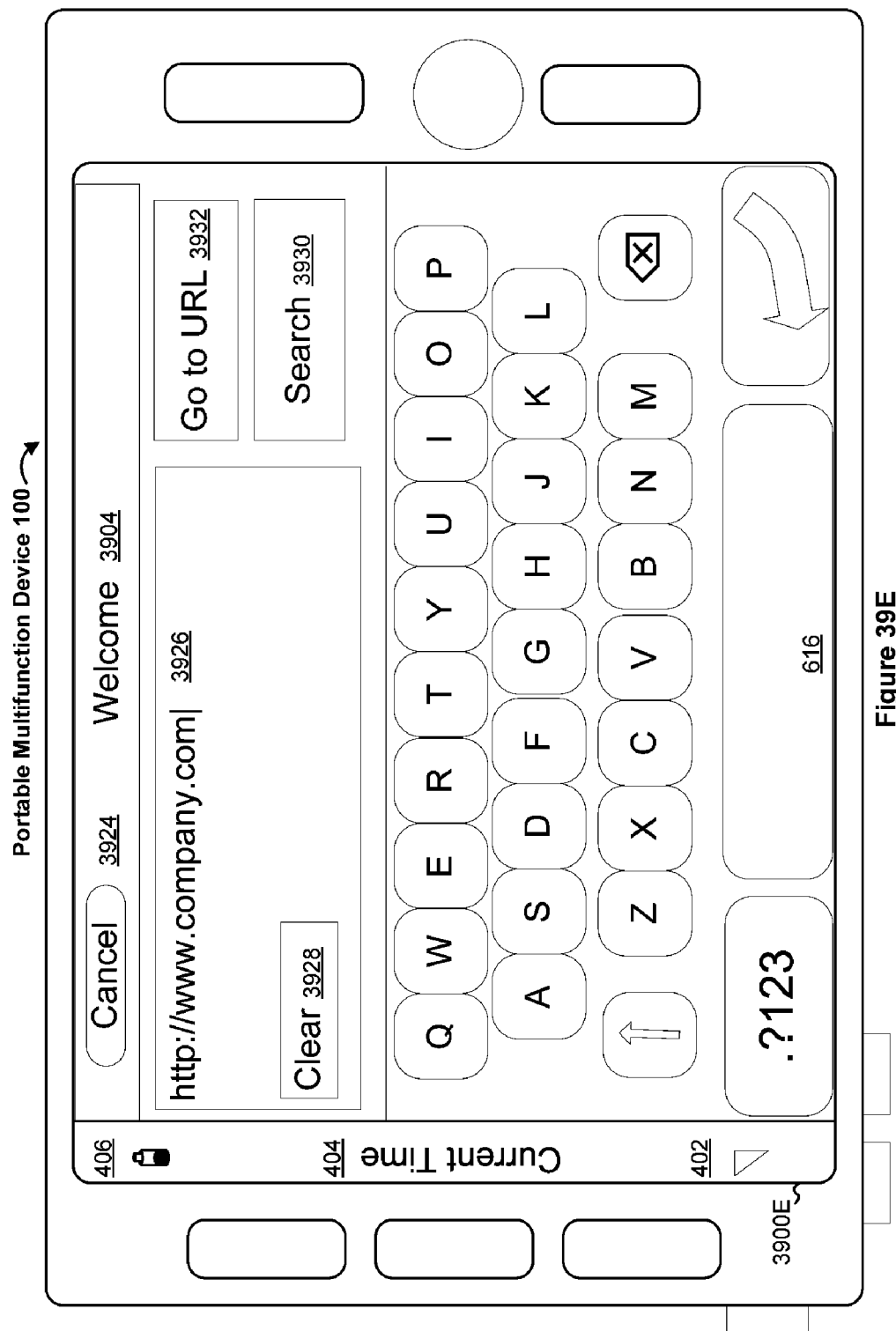
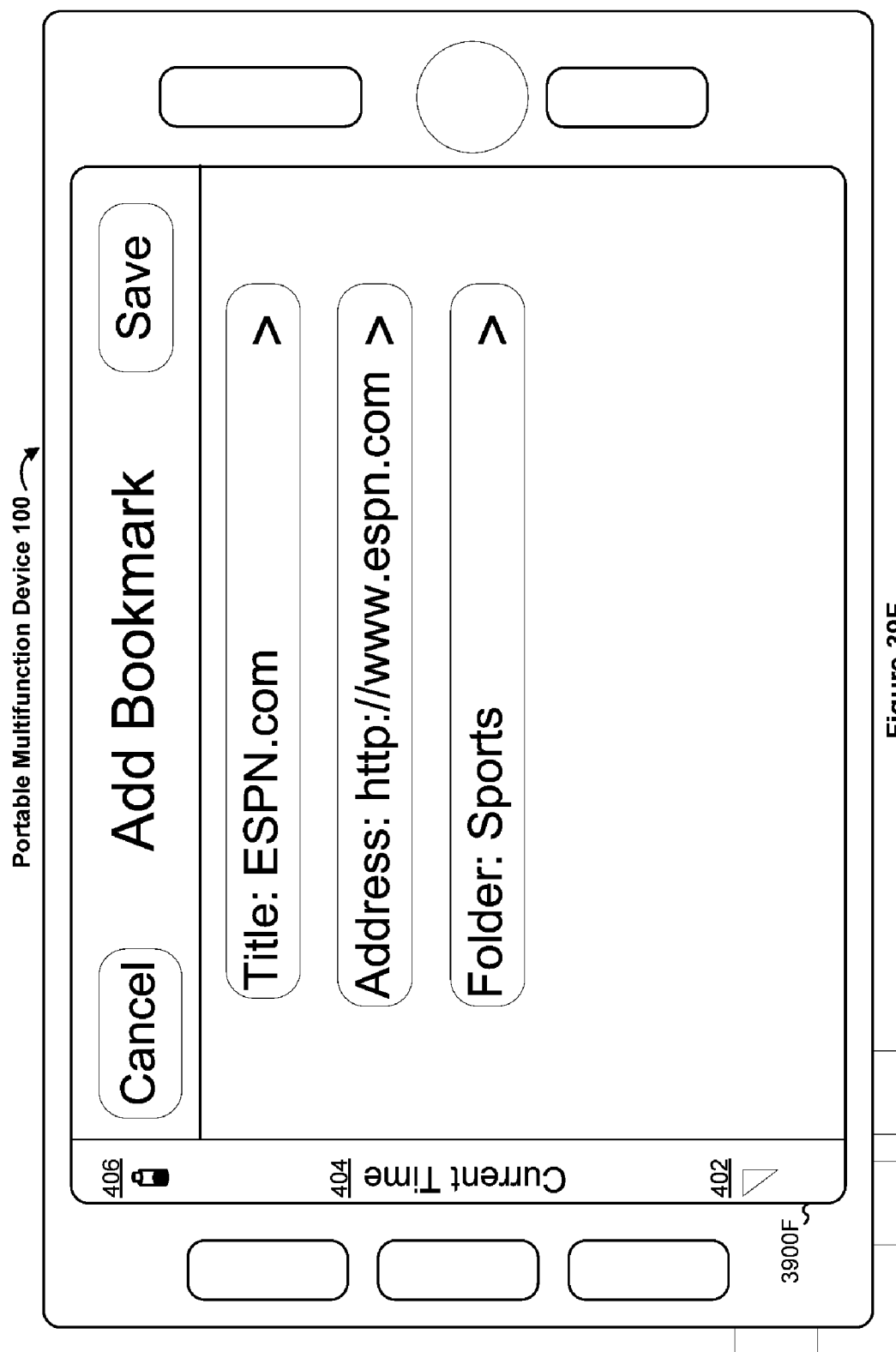


Figure 39D





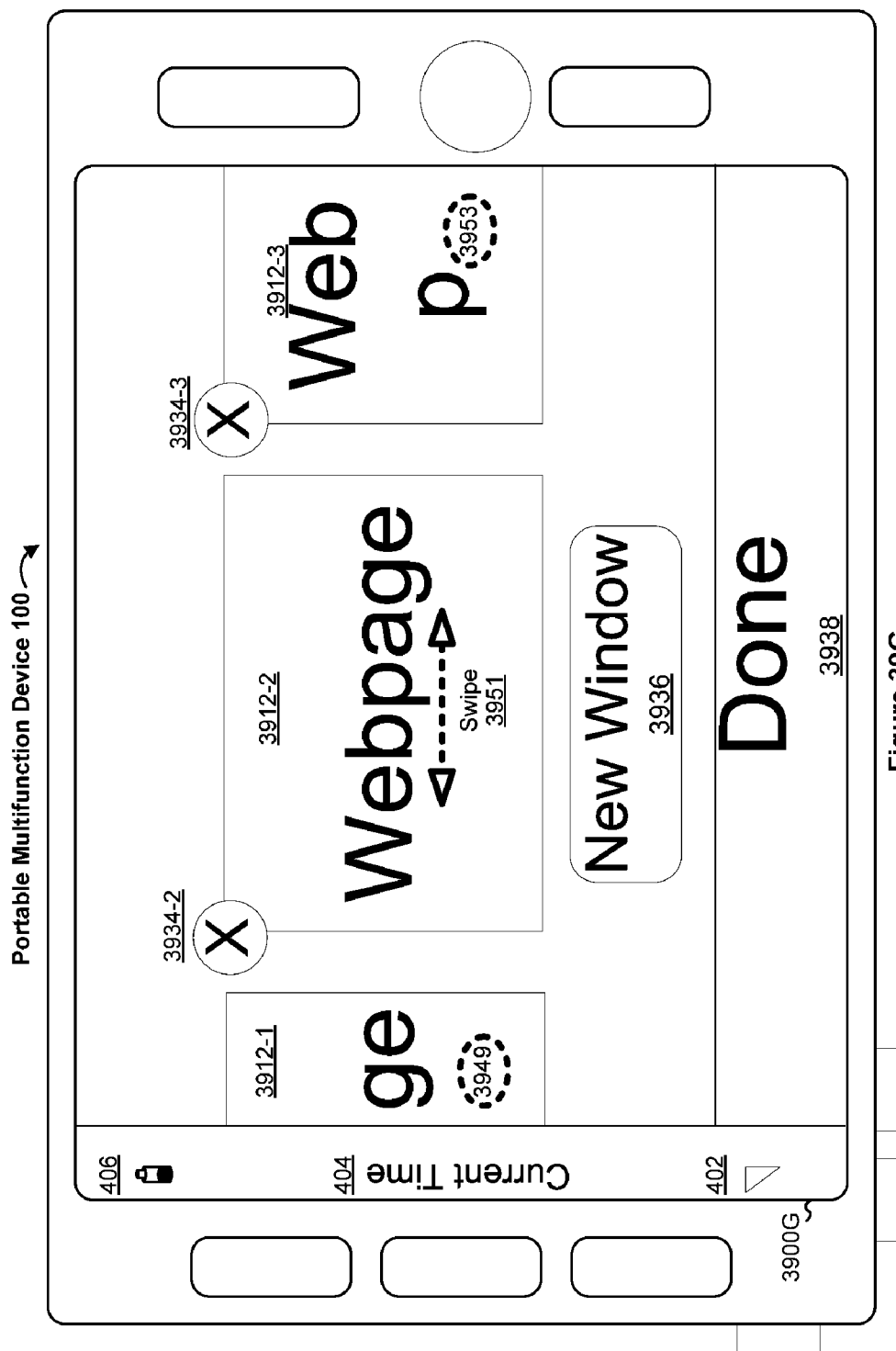


Figure 39G

U.S. Patent

Jan. 20, 2009

Sheet 155 of 293

US 7,479,949 B2

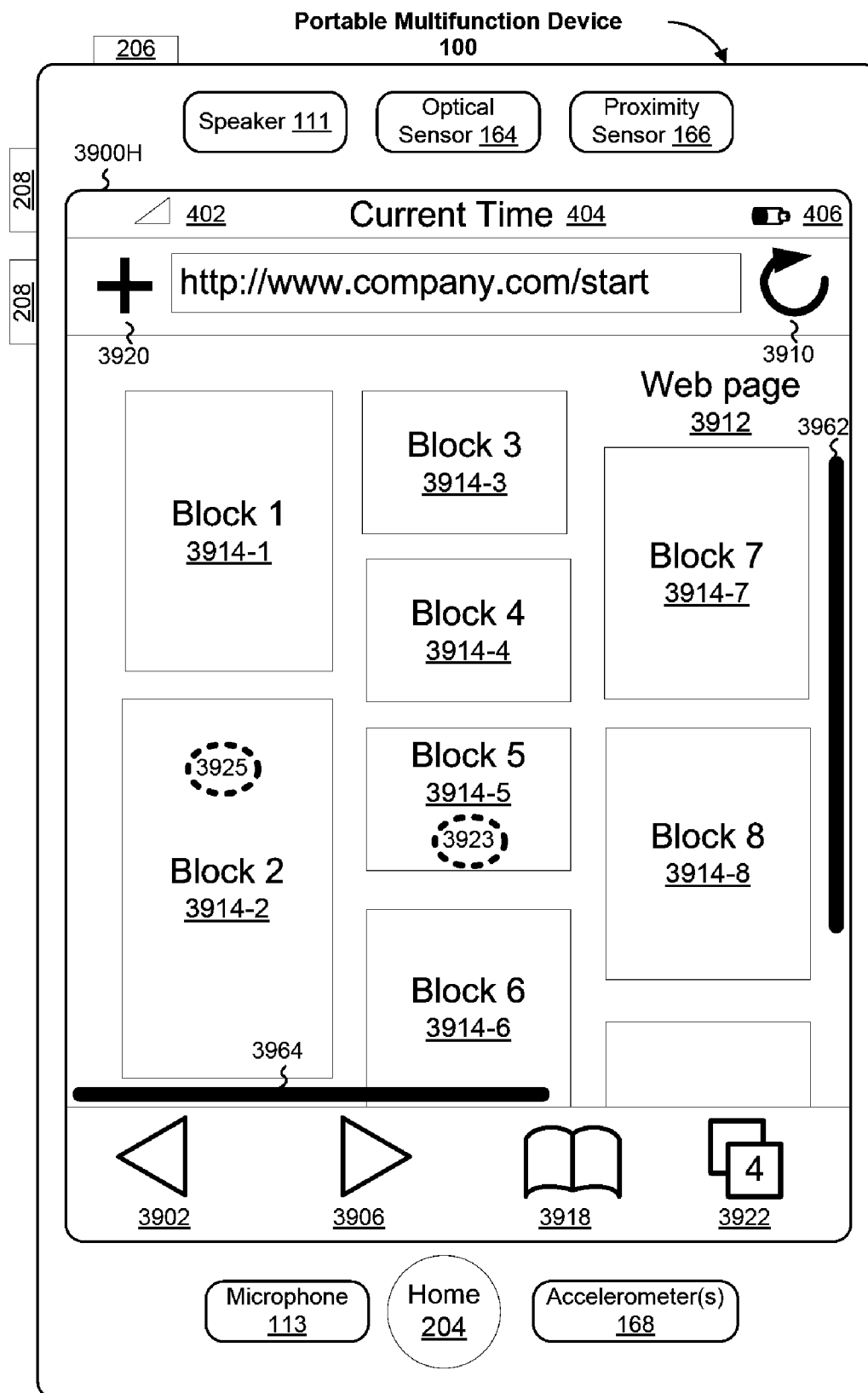


Figure 39H

U.S. Patent

Jan. 20, 2009

Sheet 156 of 293

US 7,479,949 B2

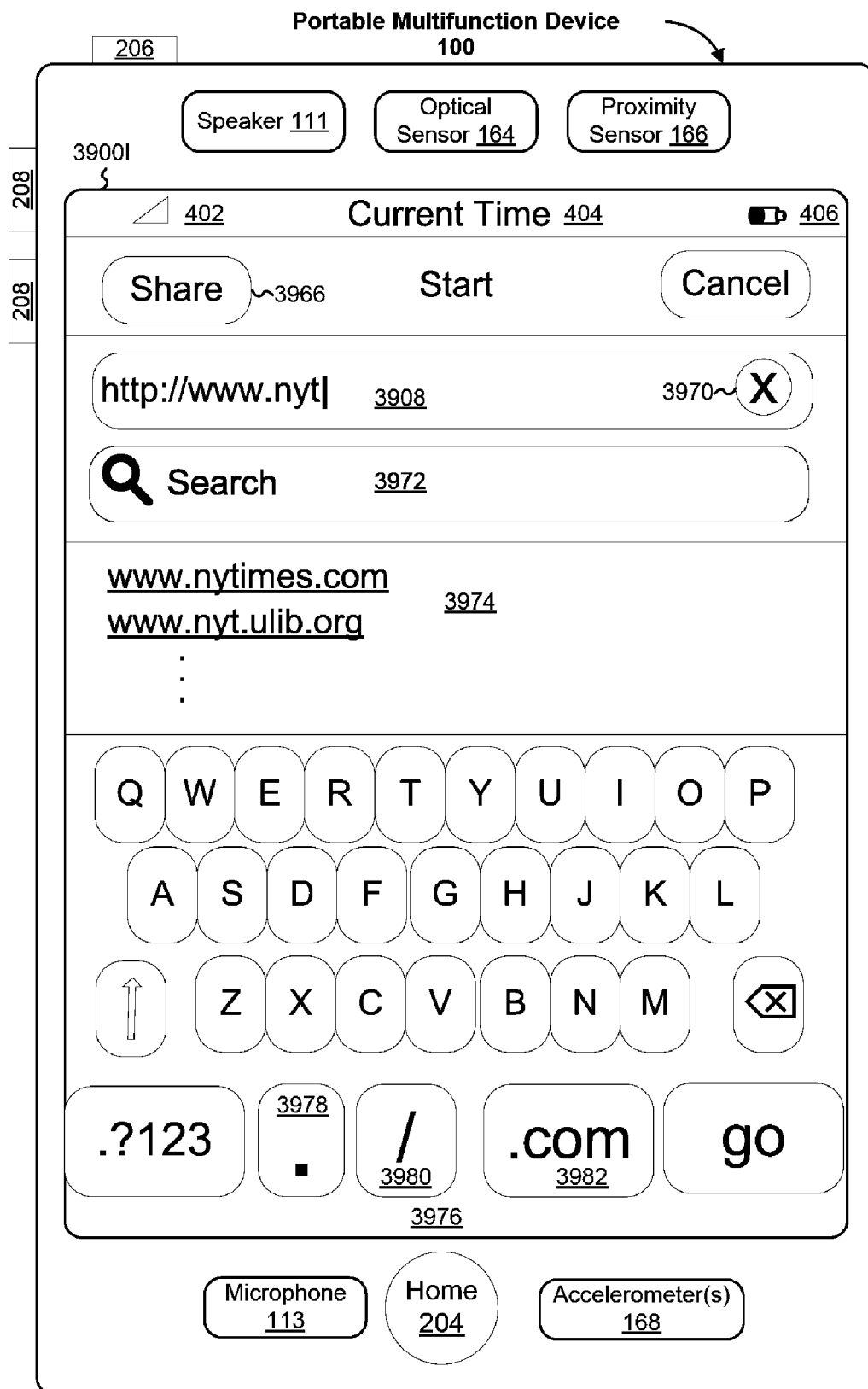


Figure 39I

U.S. Patent

Jan. 20, 2009

Sheet 157 of 293

US 7,479,949 B2

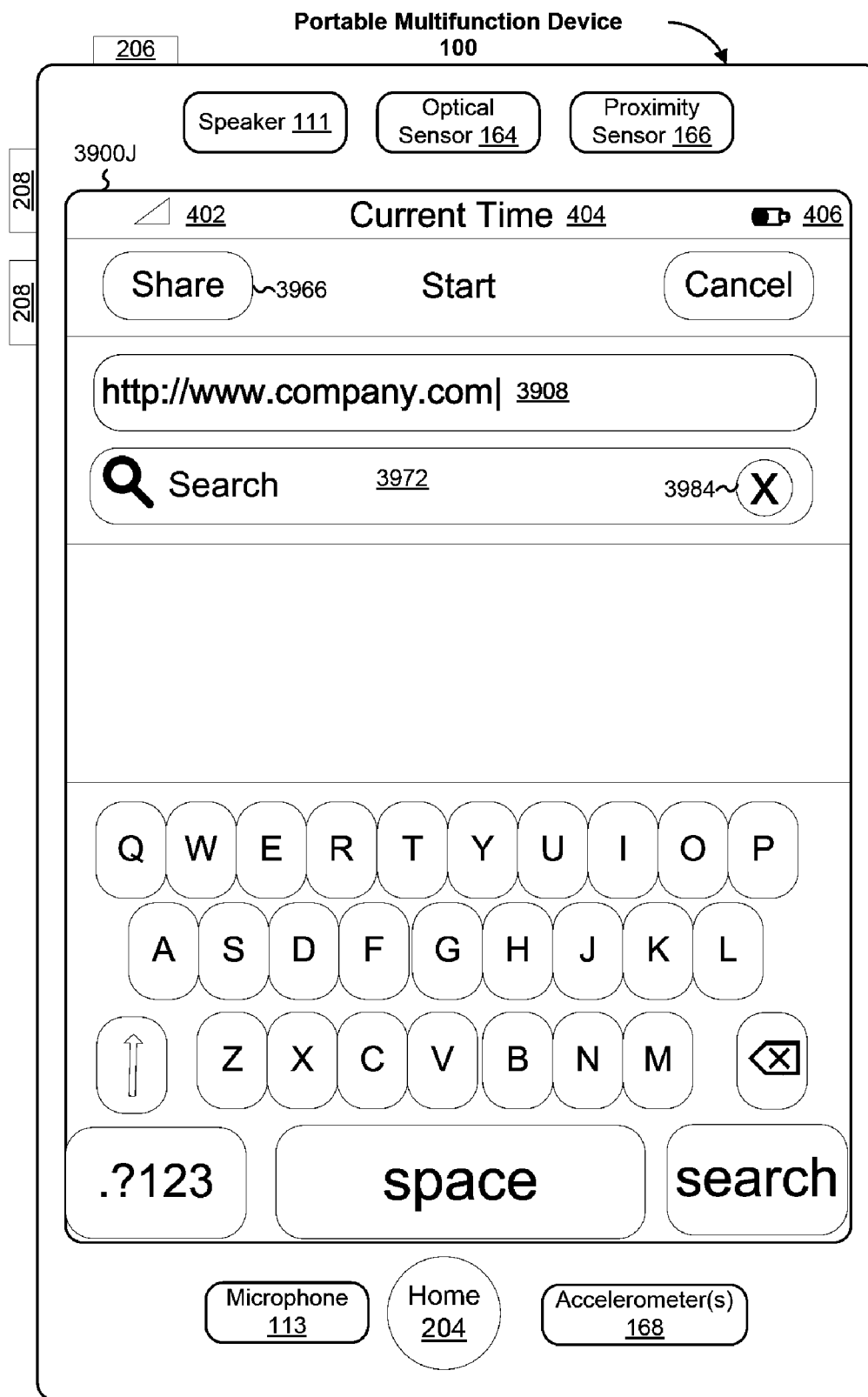


Figure 39J

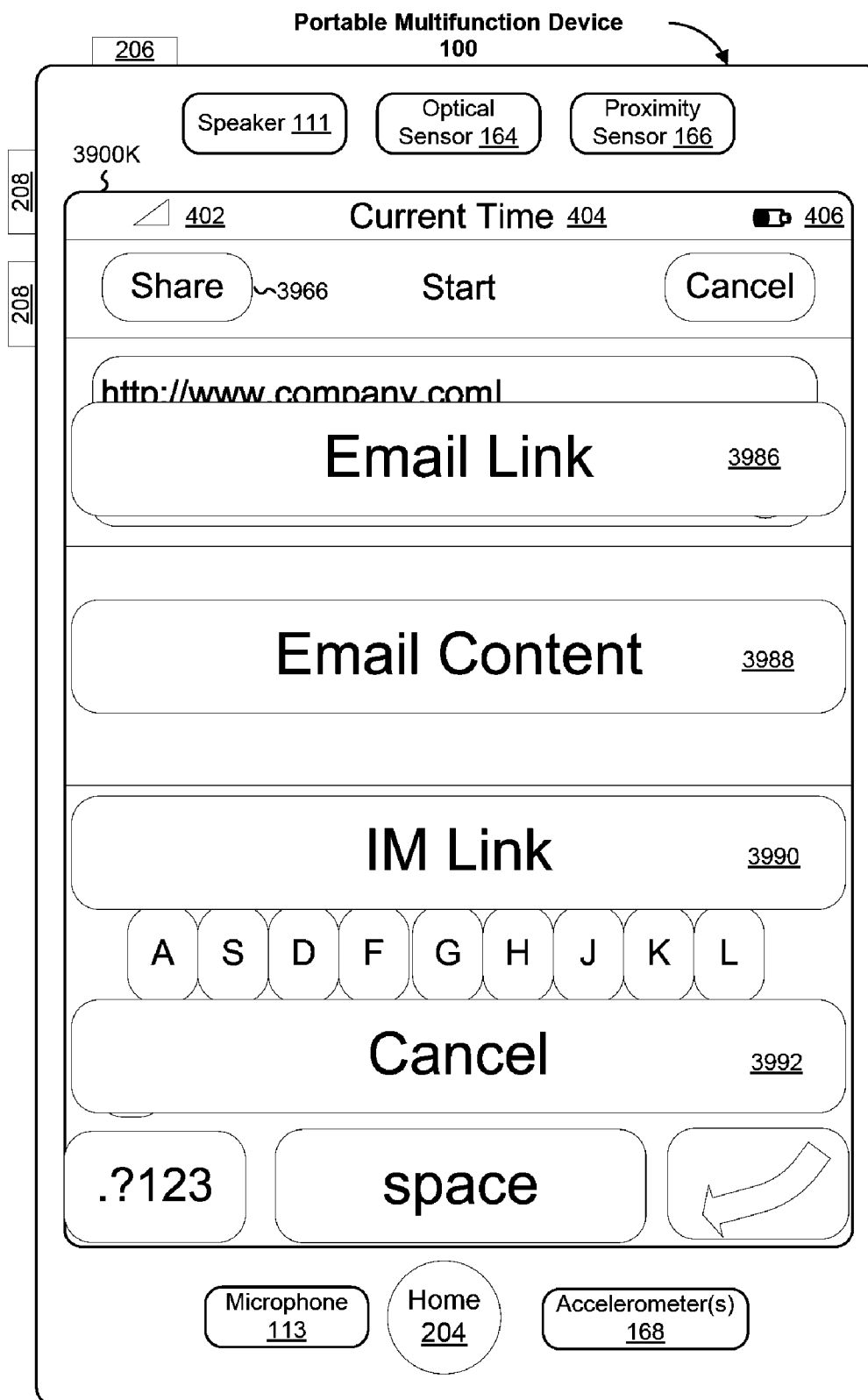
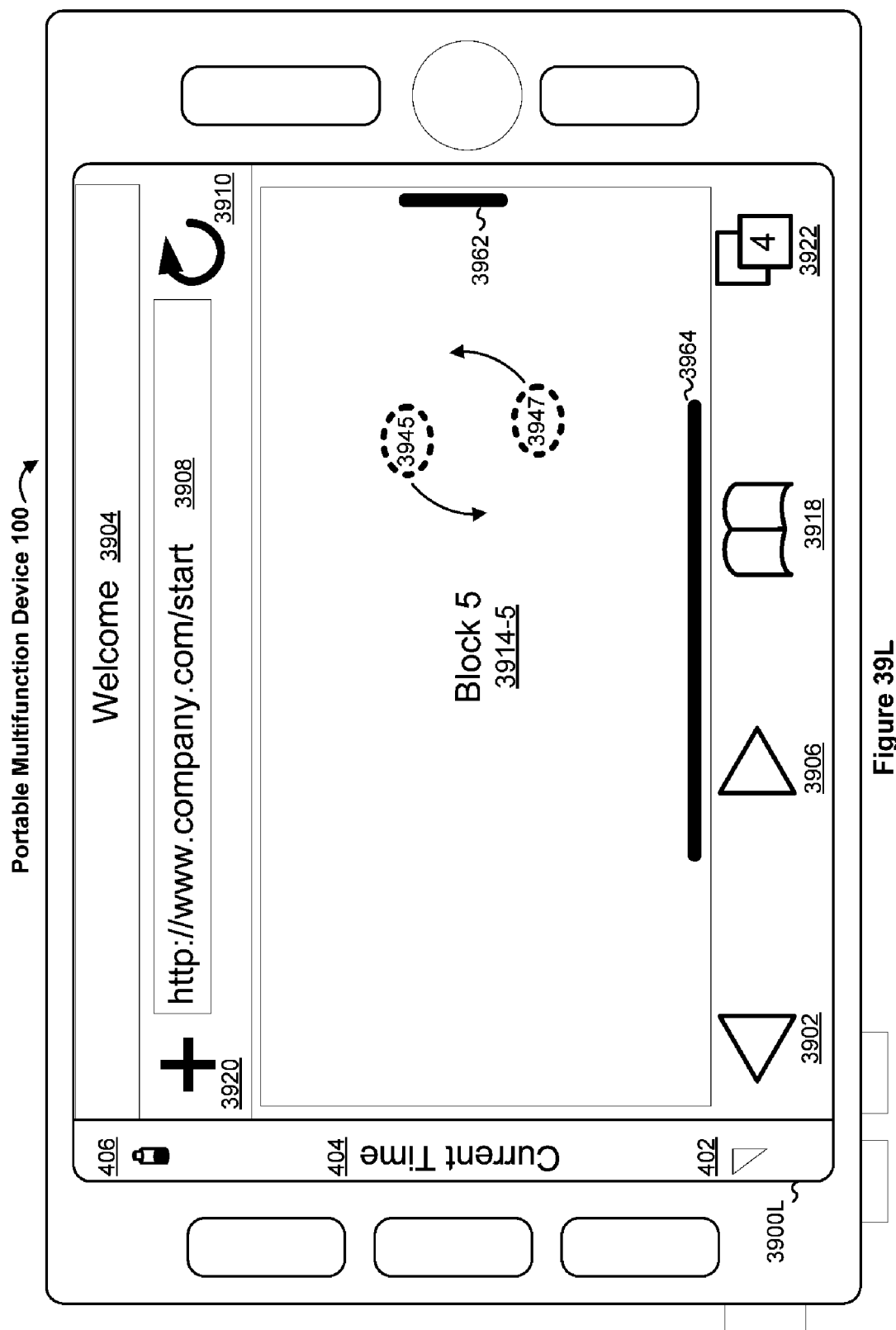


Figure 39K

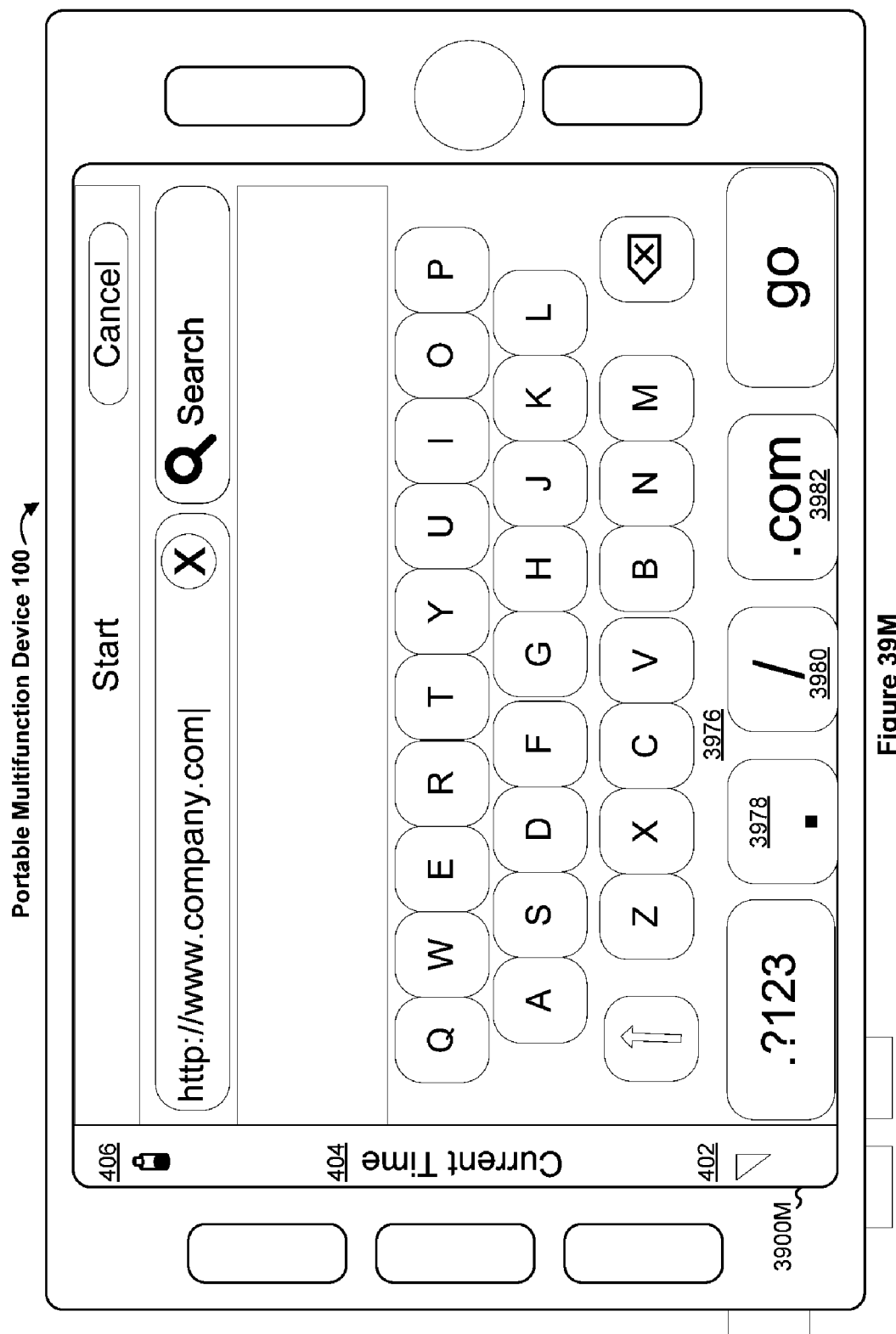


U.S. Patent

Jan. 20, 2009

Sheet 160 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 161 of 293

US 7,479,949 B2

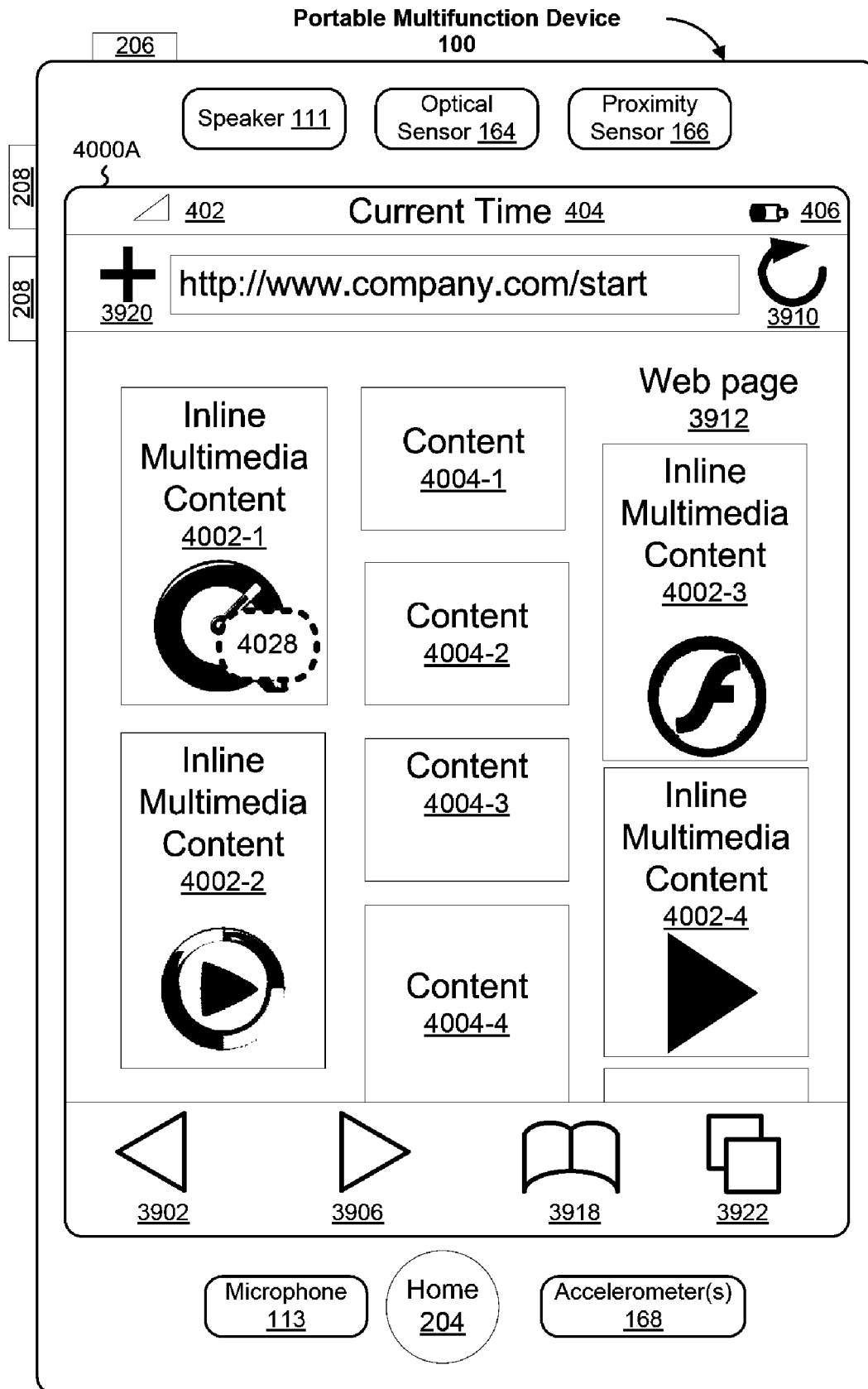


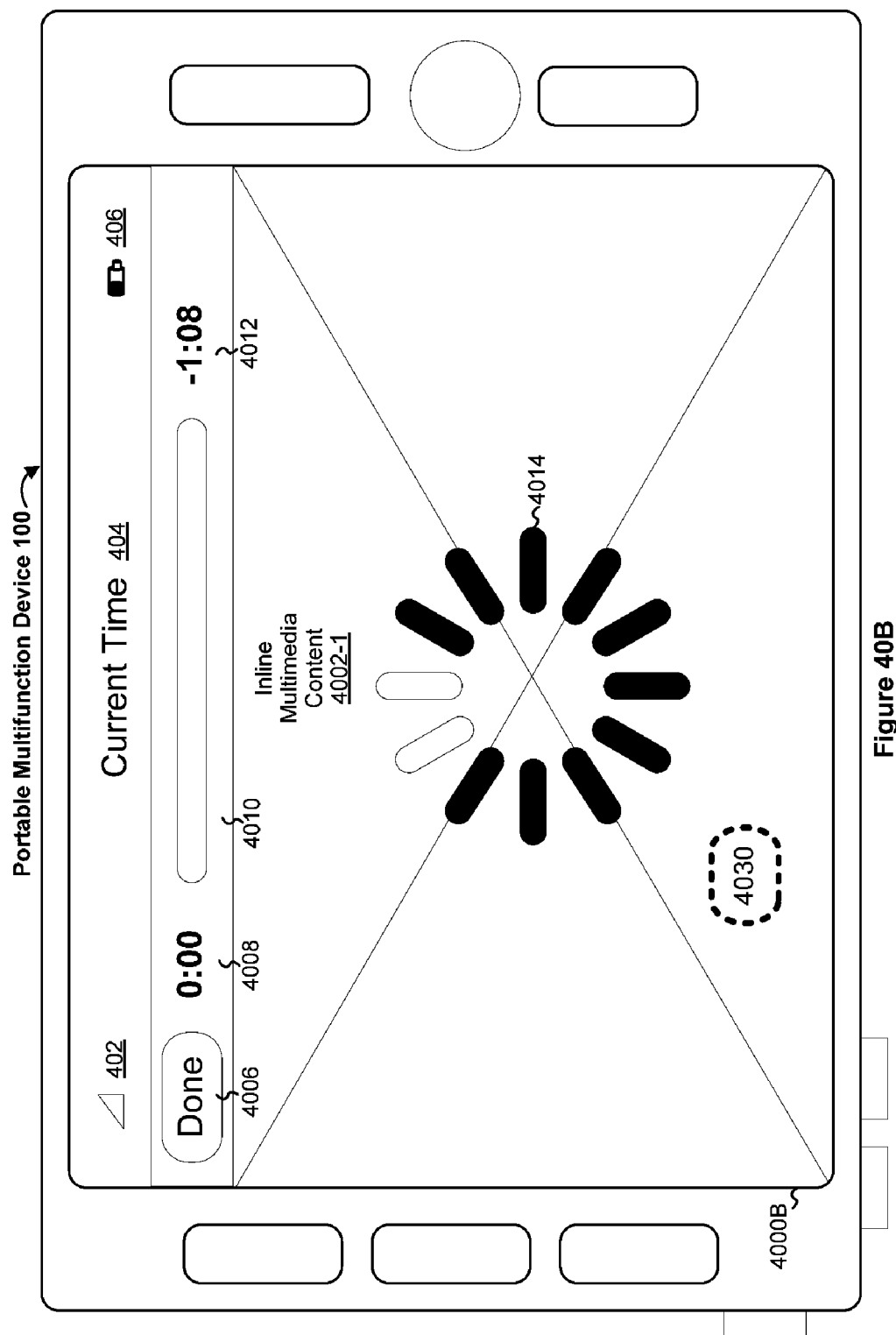
Figure 40A

U.S. Patent

Jan. 20, 2009

Sheet 162 of 293

US 7,479,949 B2

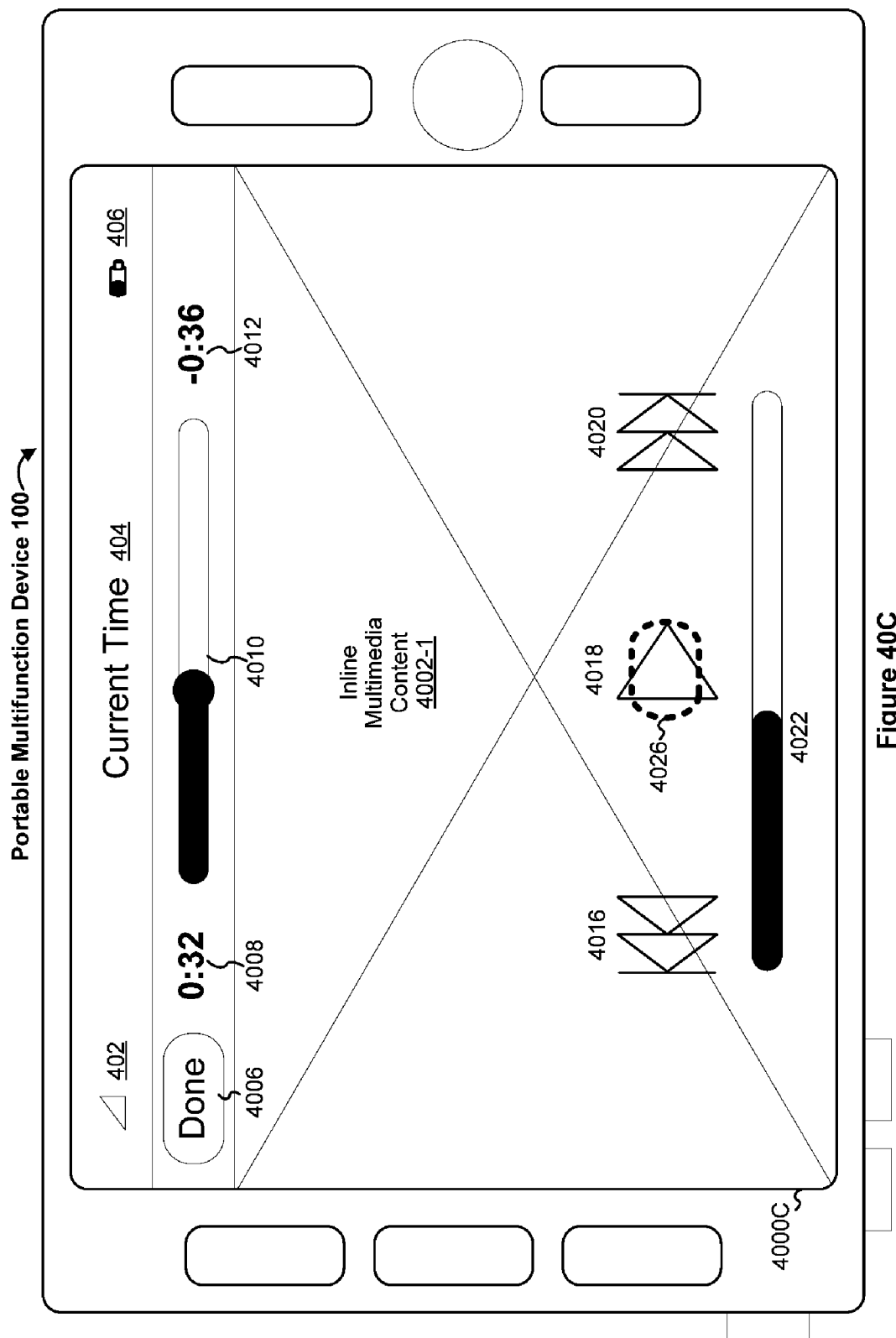


U.S. Patent

Jan. 20, 2009

Sheet 163 of 293

US 7,479,949 B2

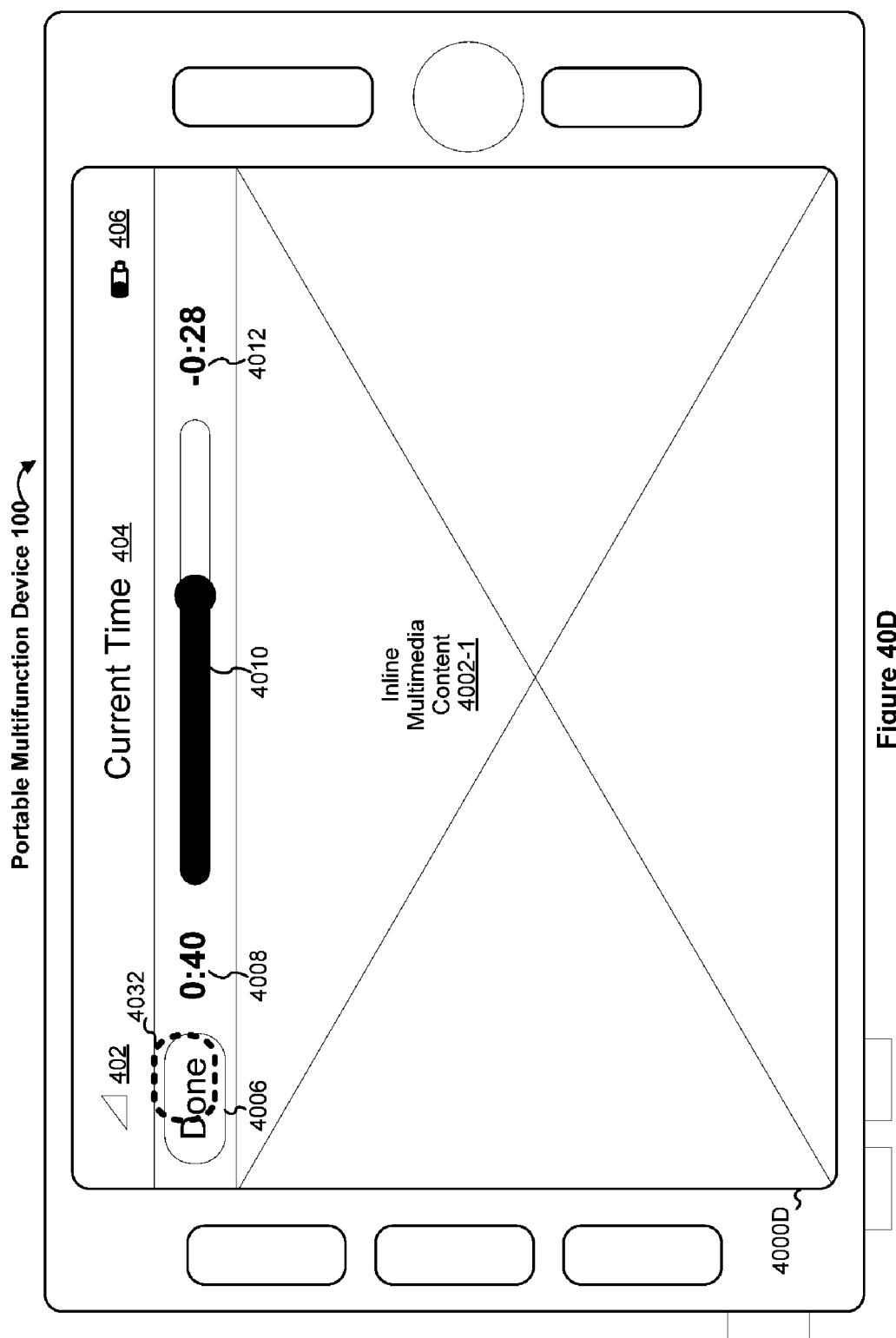


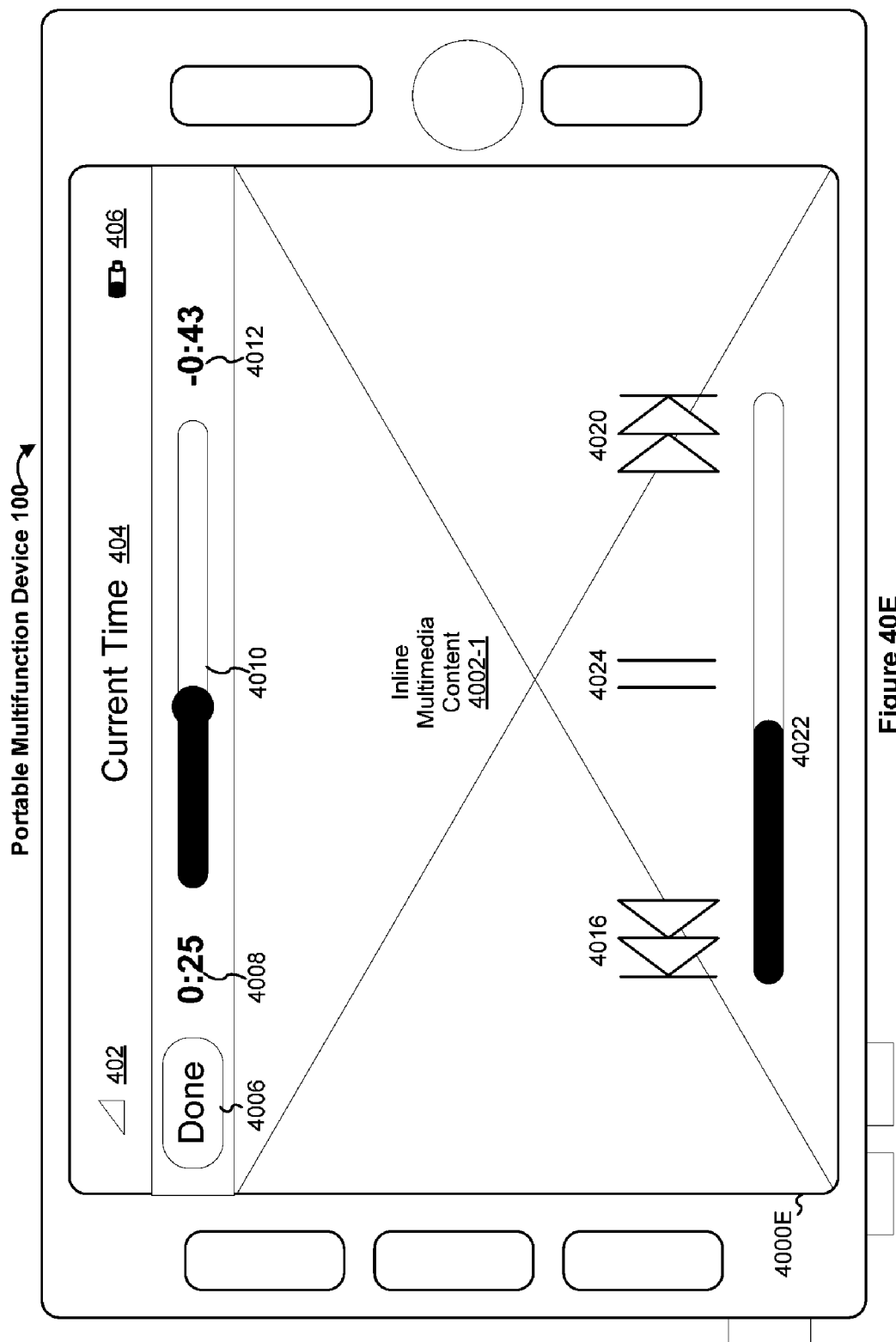
U.S. Patent

Jan. 20, 2009

Sheet 164 of 293

US 7,479,949 B2





U.S. Patent

Jan. 20, 2009

Sheet 166 of 293

US 7,479,949 B2

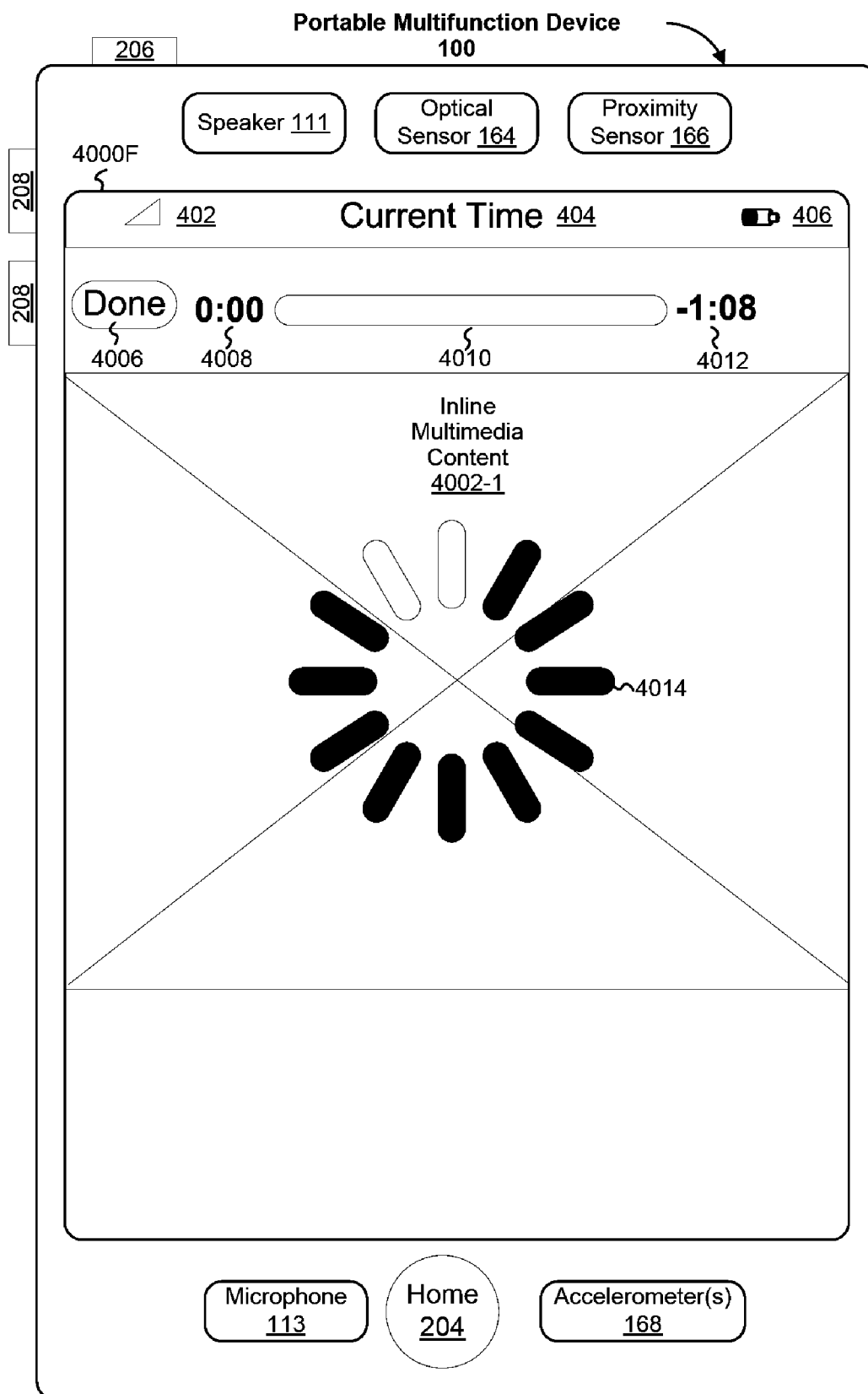


Figure 40F



Figure 41A

U.S. Patent

Jan. 20, 2009

Sheet 168 of 293

US 7,479,949 B2

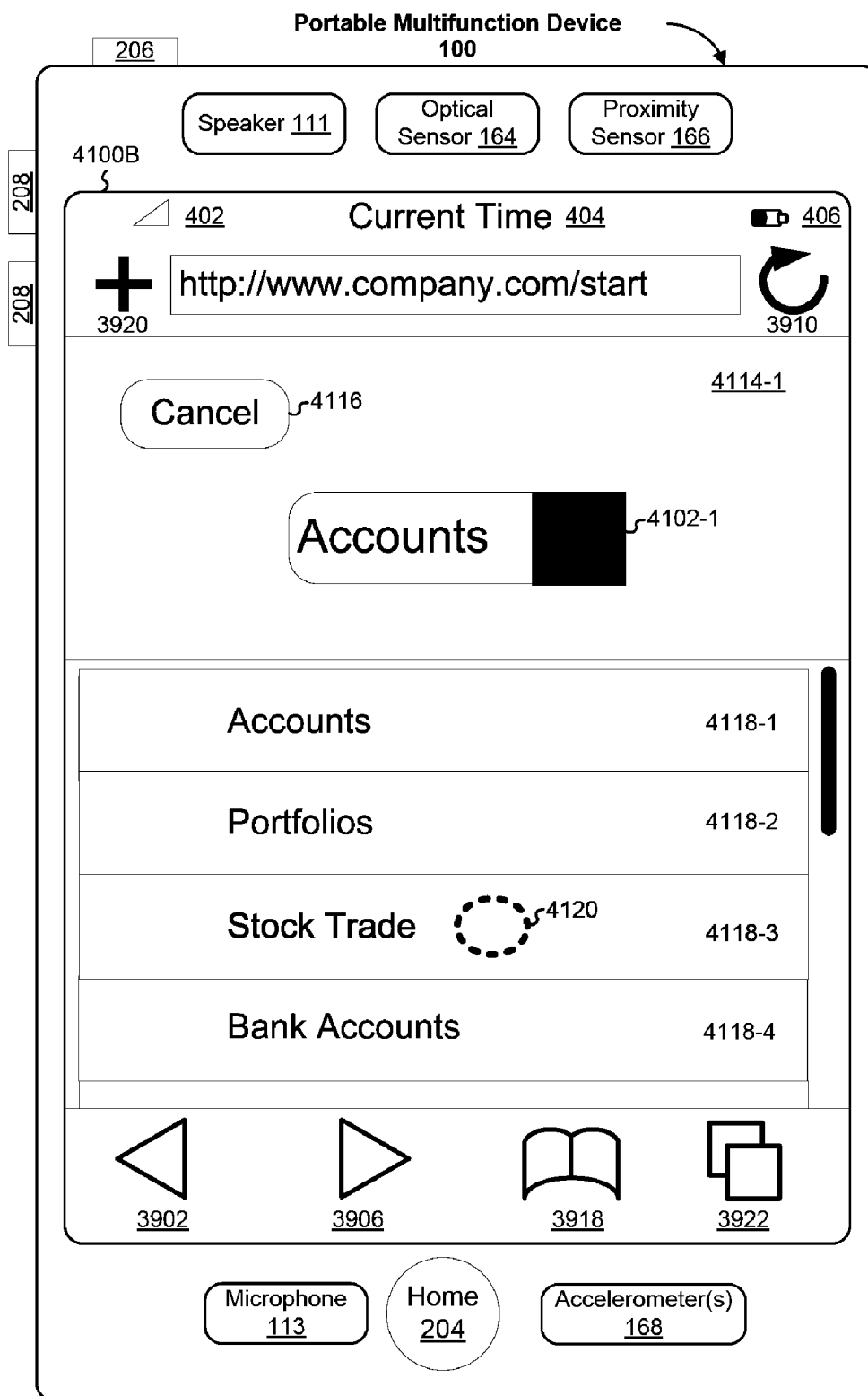


Figure 41B

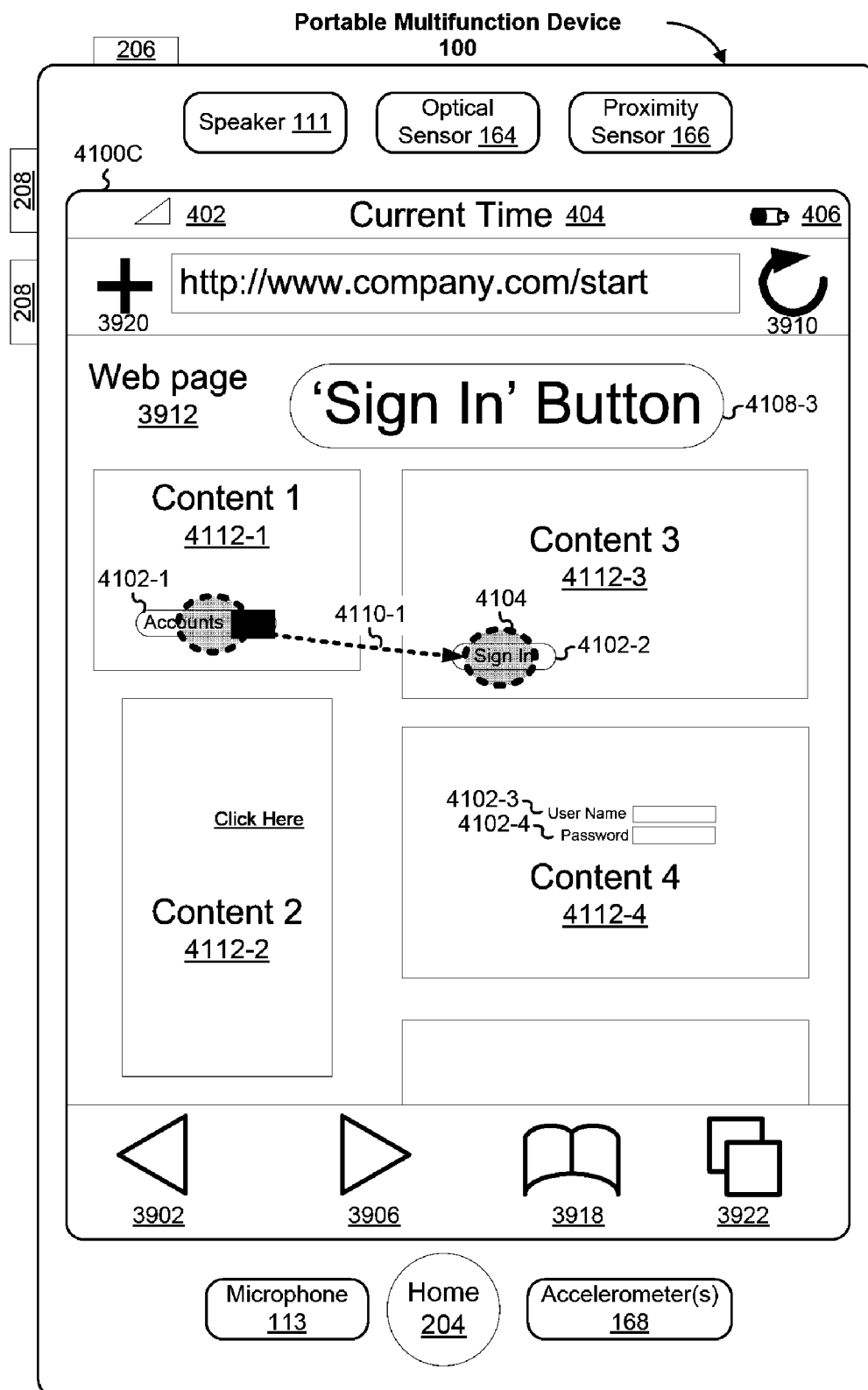


Figure 41C

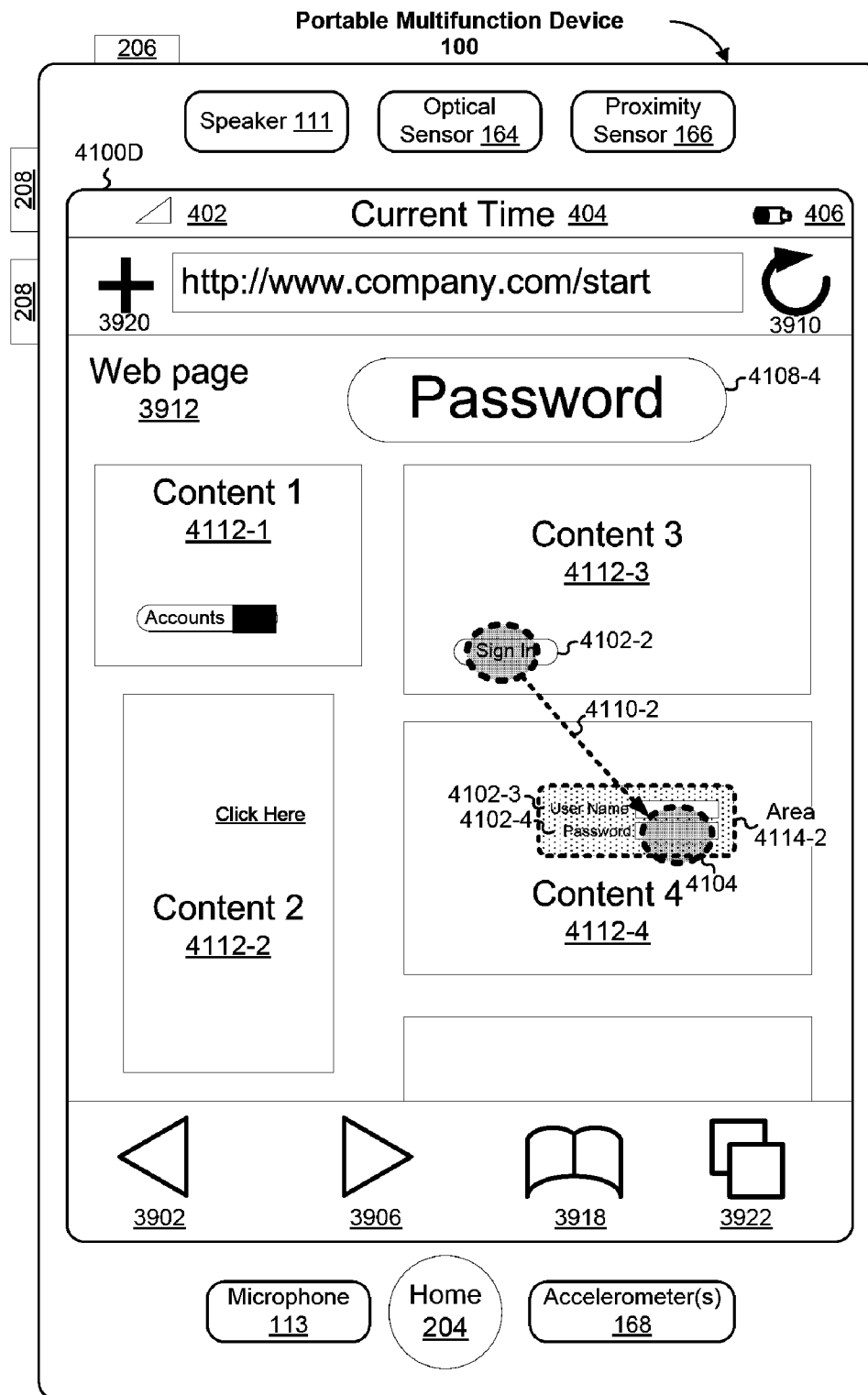


Figure 41D

U.S. Patent

Jan. 20, 2009

Sheet 171 of 293

US 7,479,949 B2

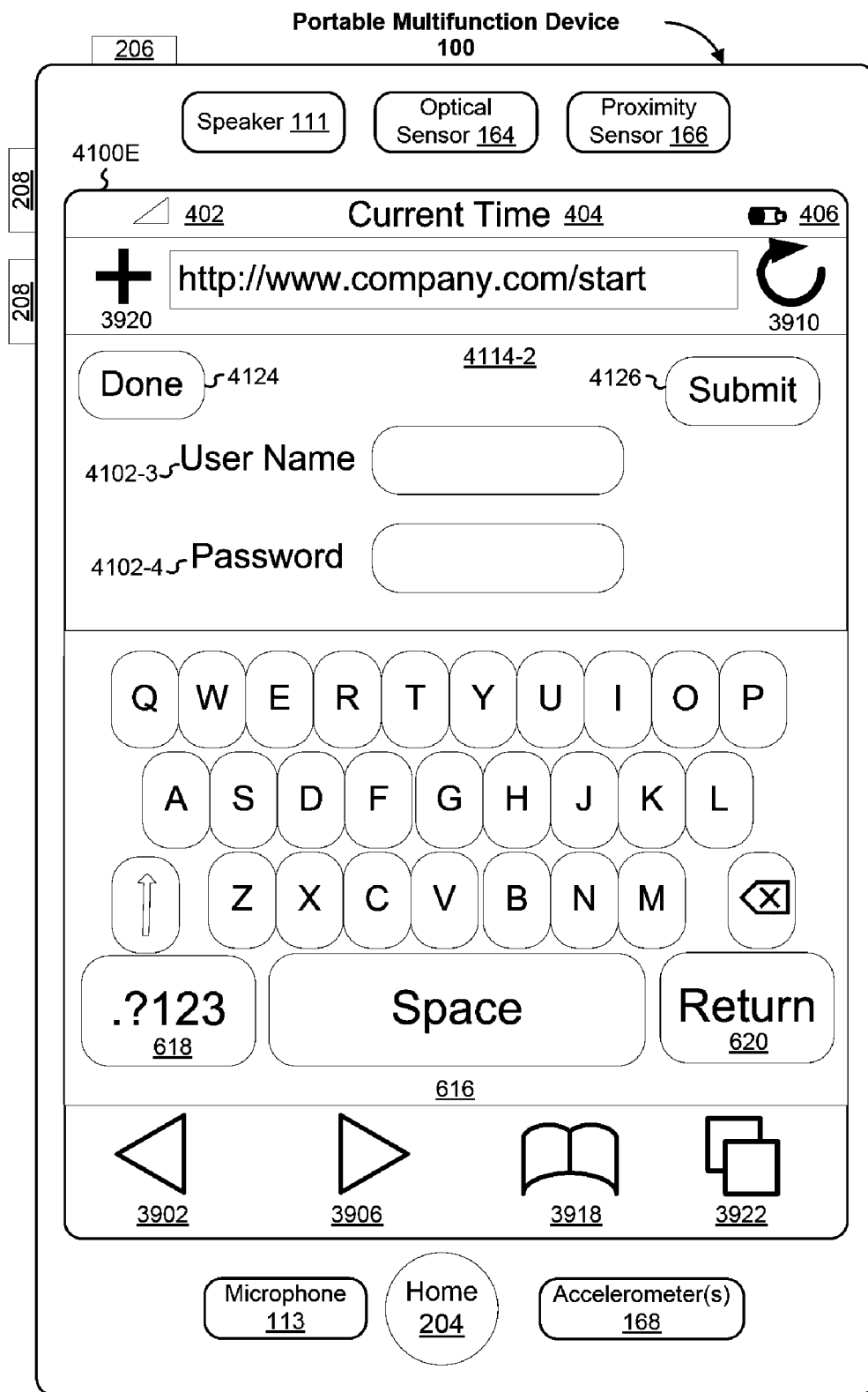


Figure 41E

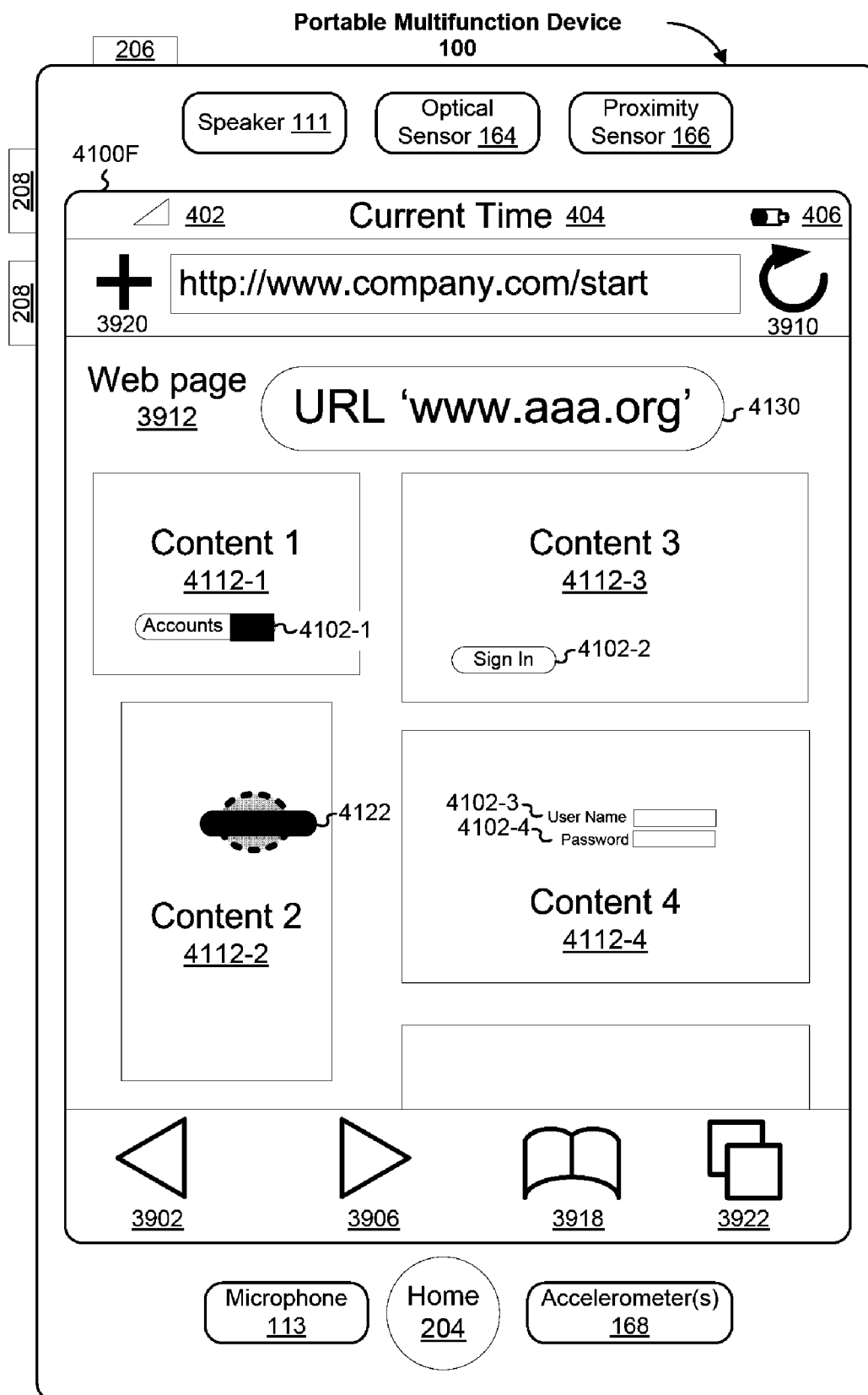


Figure 41F

U.S. Patent

Jan. 20, 2009

Sheet 173 of 293

US 7,479,949 B2

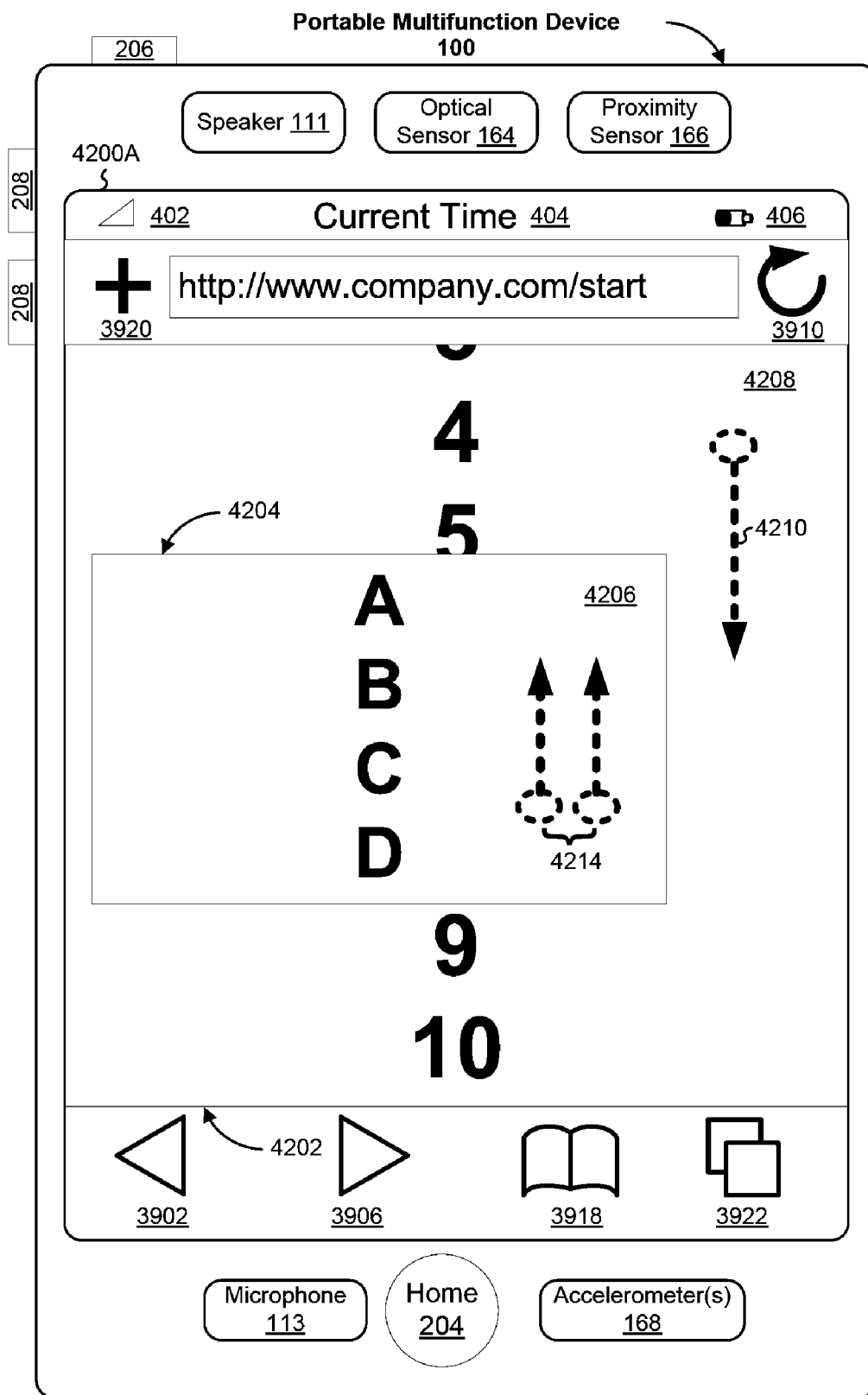


Figure 42A

U.S. Patent

Jan. 20, 2009

Sheet 174 of 293

US 7,479,949 B2

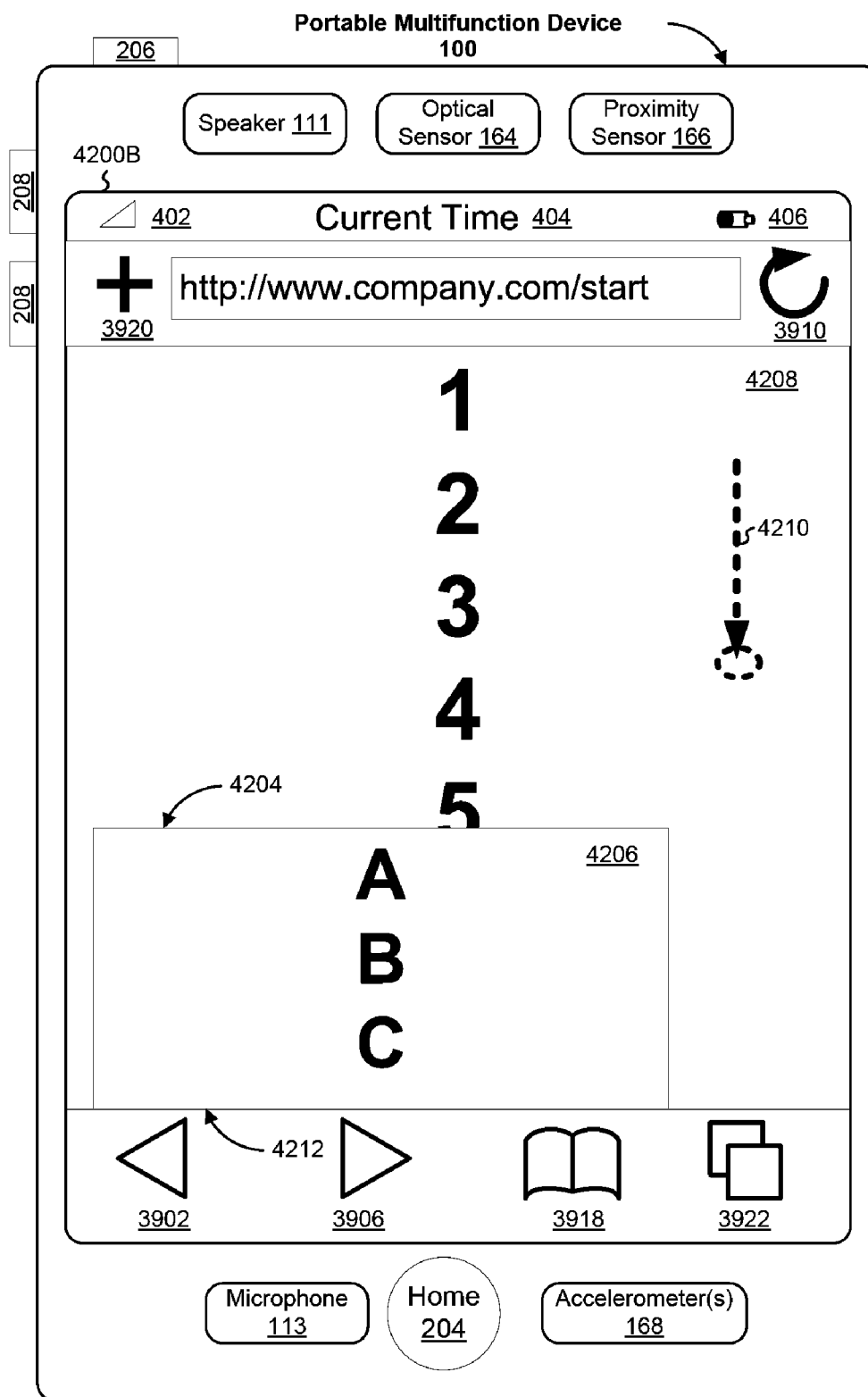


Figure 42B

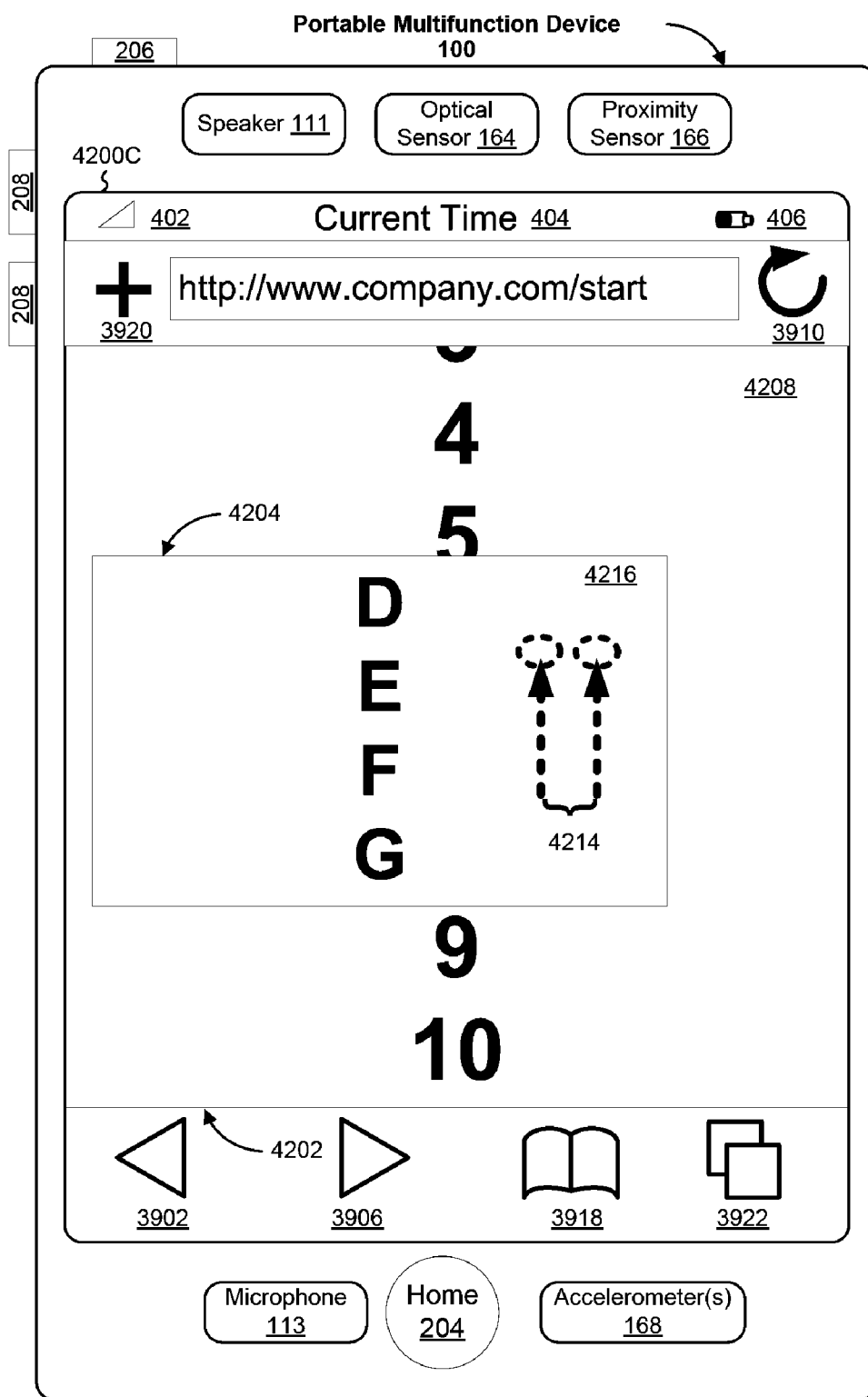


Figure 42C

U.S. Patent

Jan. 20, 2009

Sheet 176 of 293

US 7,479,949 B2



Figure 43A

U.S. Patent

Jan. 20, 2009

Sheet 177 of 293

US 7,479,949 B2



Figure 43B

U.S. Patent

Jan. 20, 2009

Sheet 178 of 293

US 7,479,949 B2



U.S. Patent

Jan. 20, 2009

Sheet 179 of 293

US 7,479,949 B2

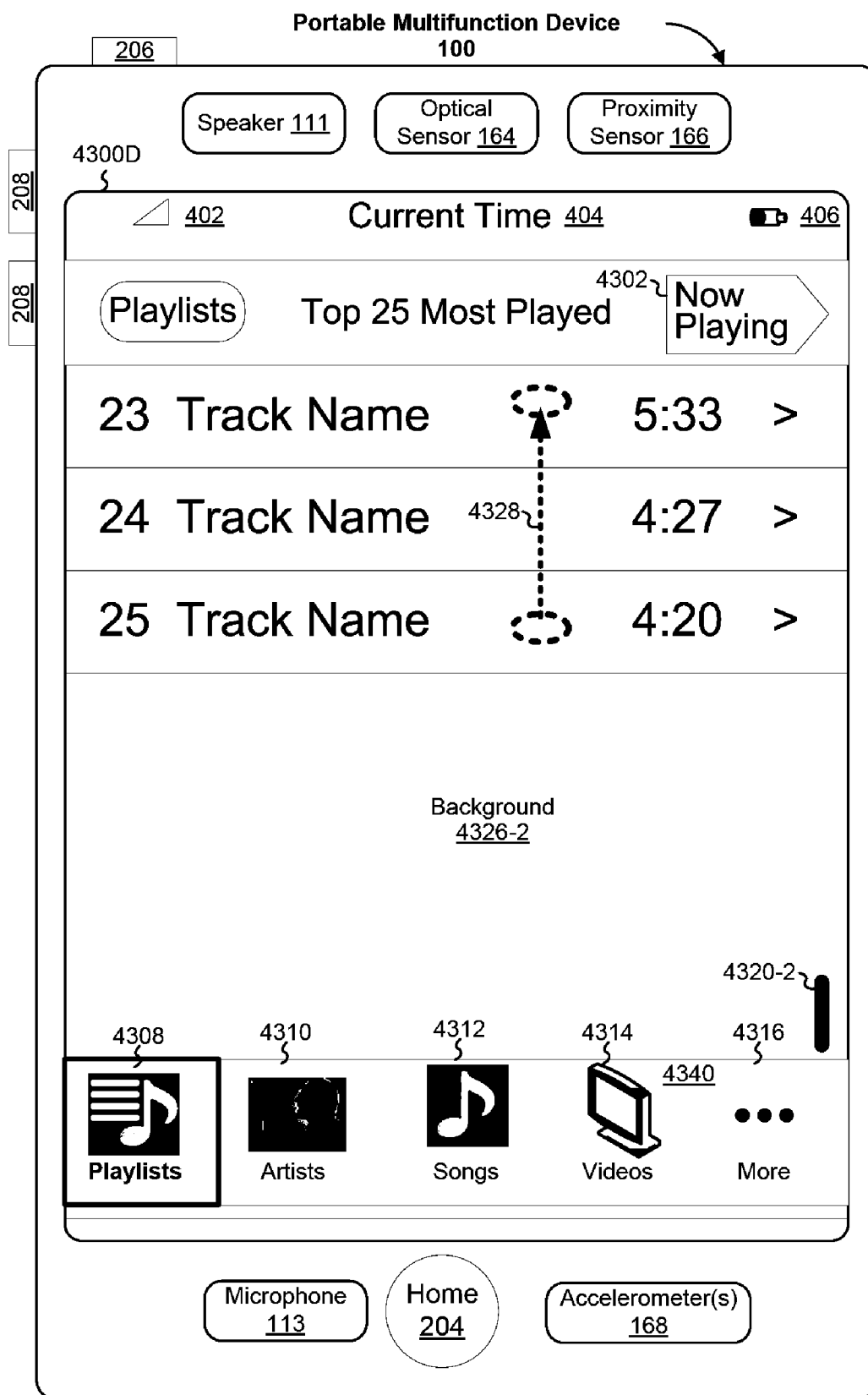


Figure 43D

U.S. Patent

Jan. 20, 2009

Sheet 180 of 293

US 7,479,949 B2

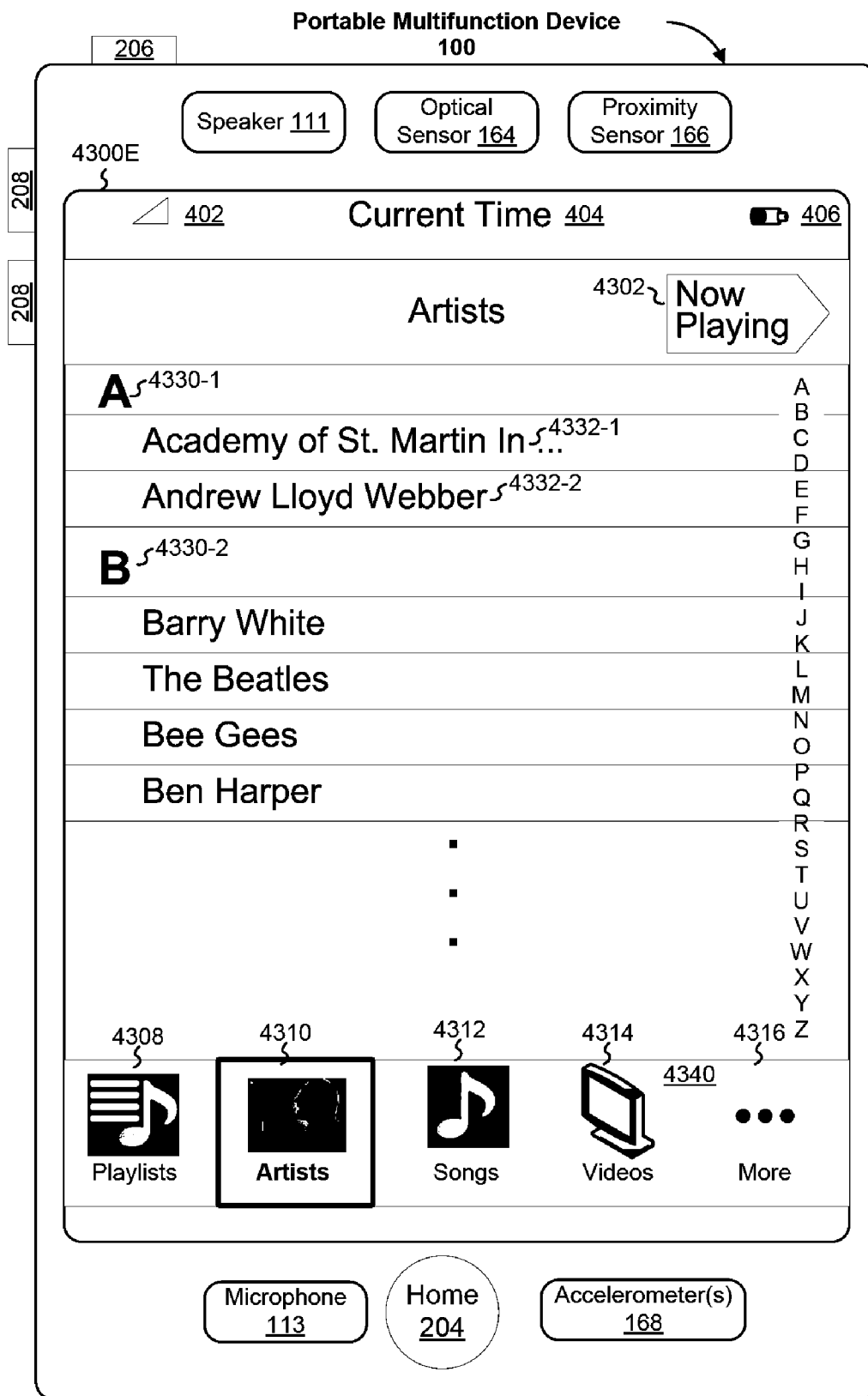


Figure 43E

U.S. Patent

Jan. 20, 2009

Sheet 181 of 293

US 7,479,949 B2

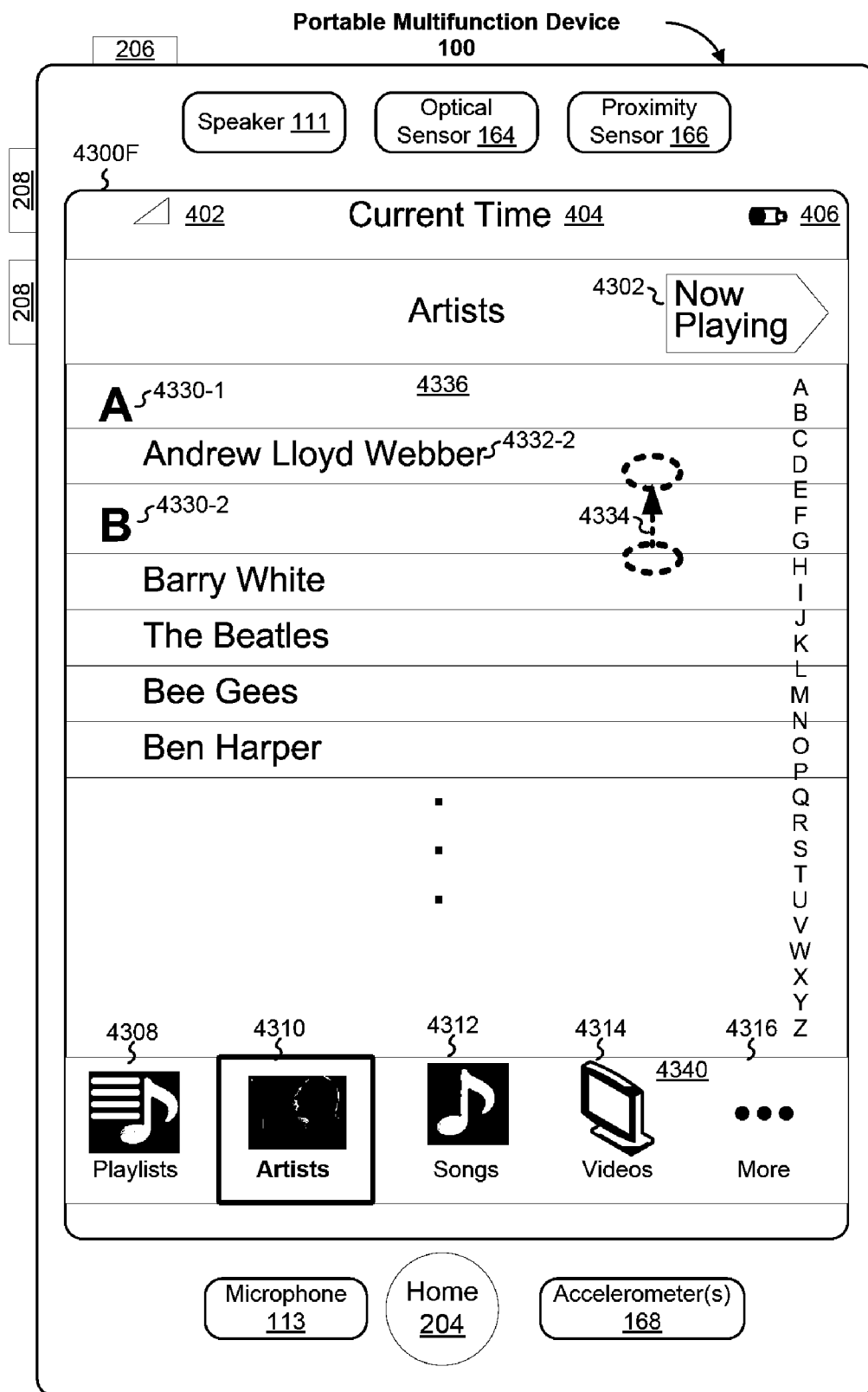


Figure 43F

U.S. Patent

Jan. 20, 2009

Sheet 182 of 293

US 7,479,949 B2

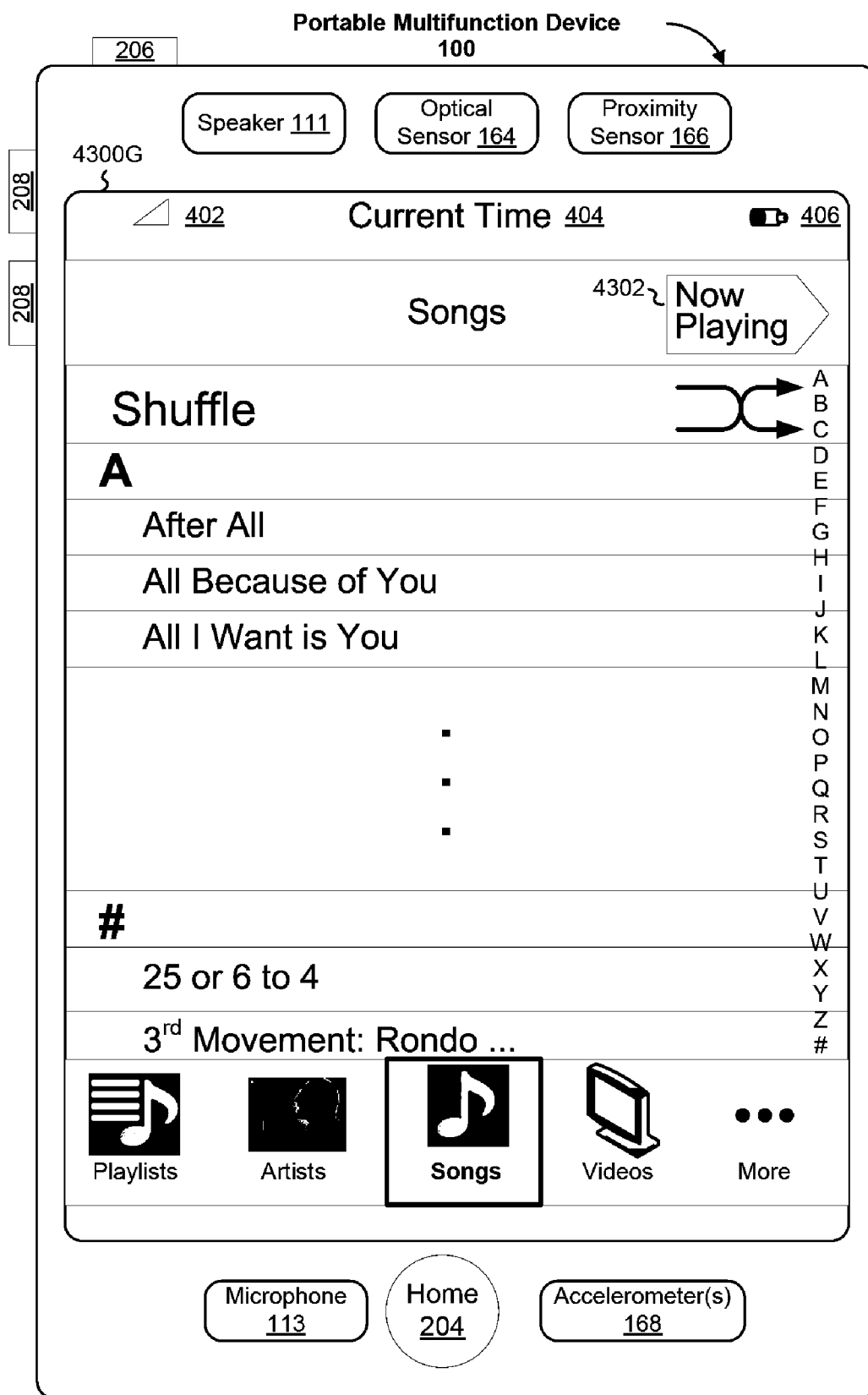


Figure 43G

U.S. Patent

Jan. 20, 2009

Sheet 183 of 293

US 7,479,949 B2

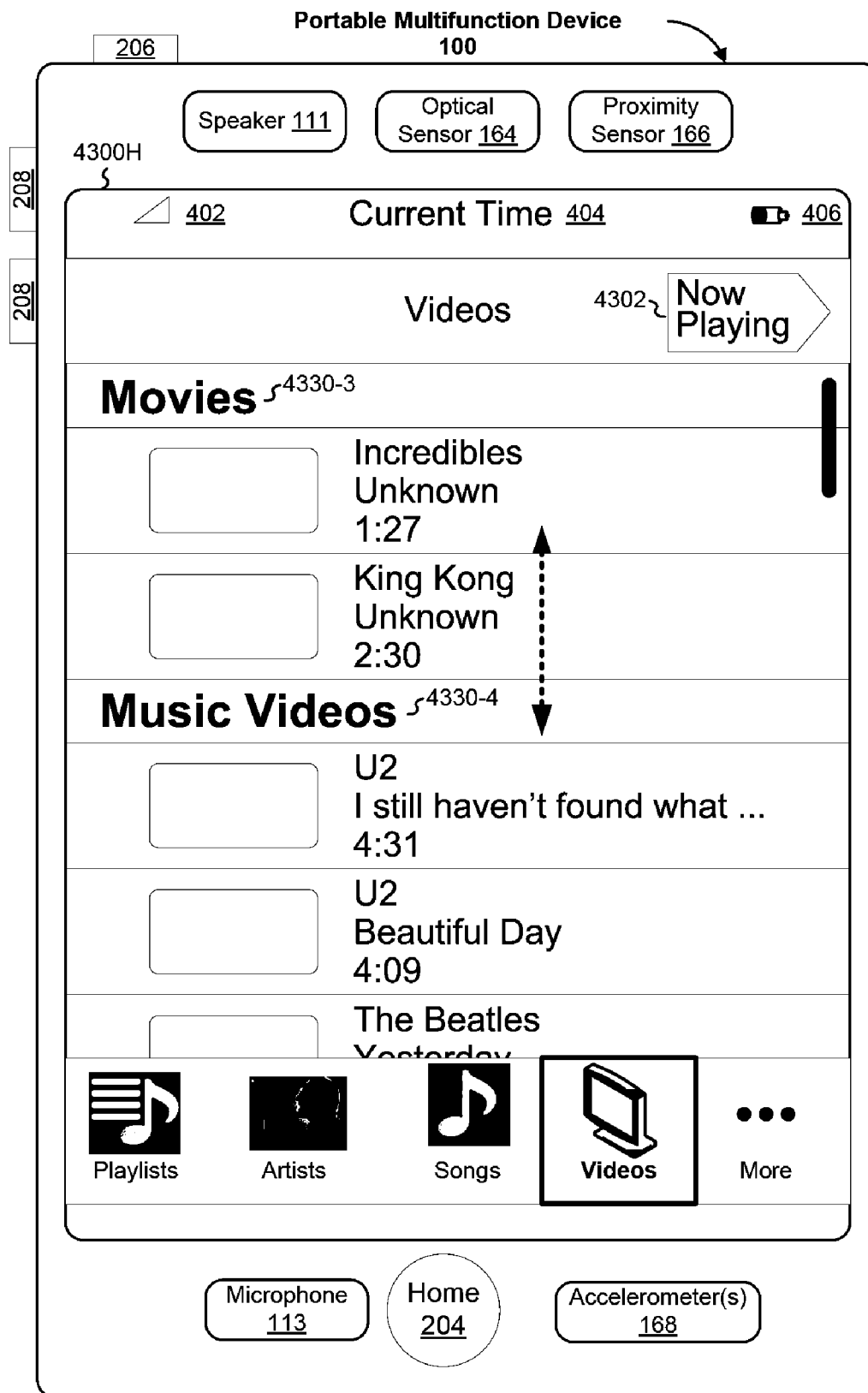


Figure 43H

U.S. Patent

Jan. 20, 2009

Sheet 184 of 293

US 7,479,949 B2

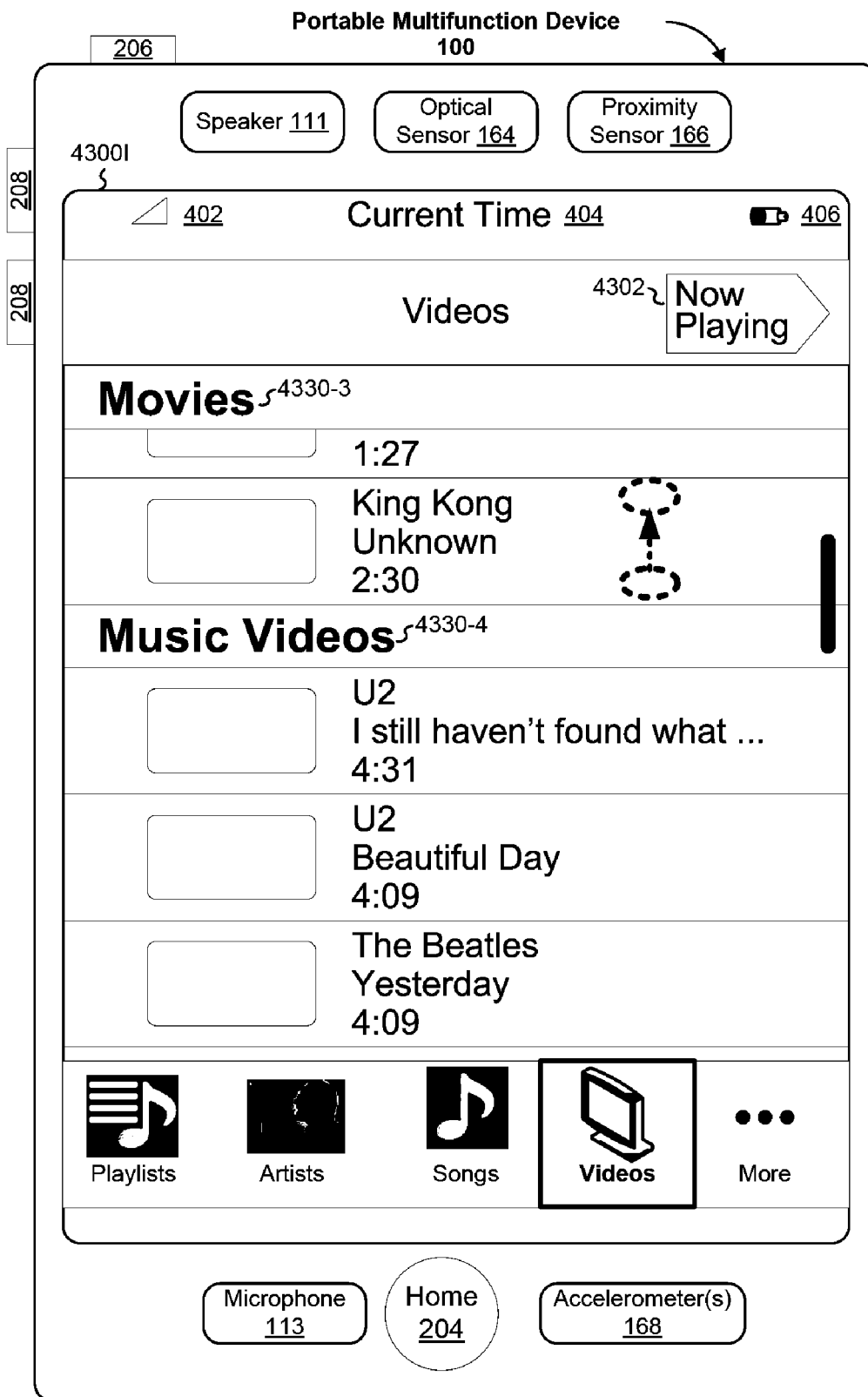


Figure 43I

U.S. Patent

Jan. 20, 2009

Sheet 185 of 293

US 7,479,949 B2



Figure 43J

U.S. Patent

Jan. 20, 2009

Sheet 186 of 293

US 7,479,949 B2

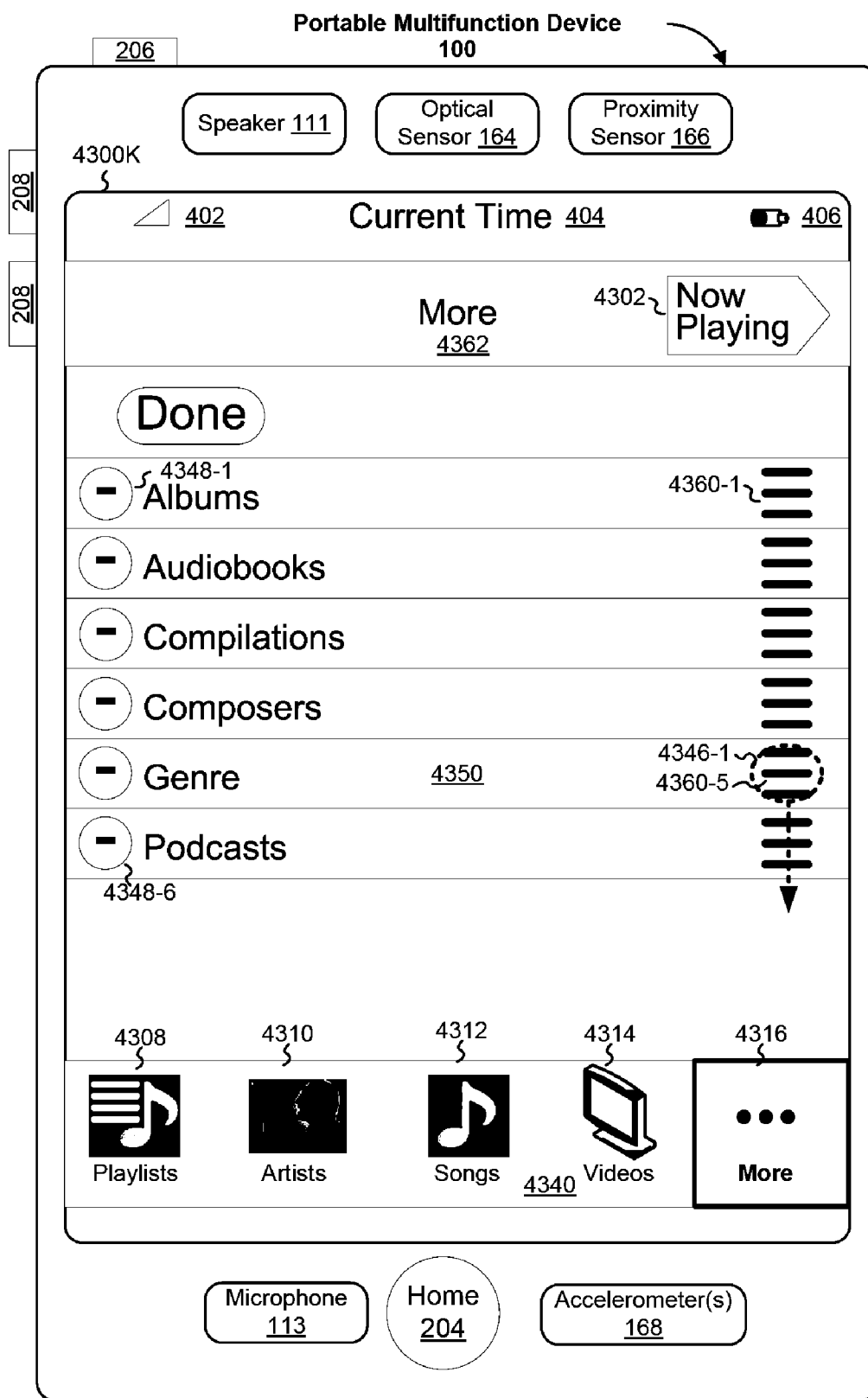


Figure 43K

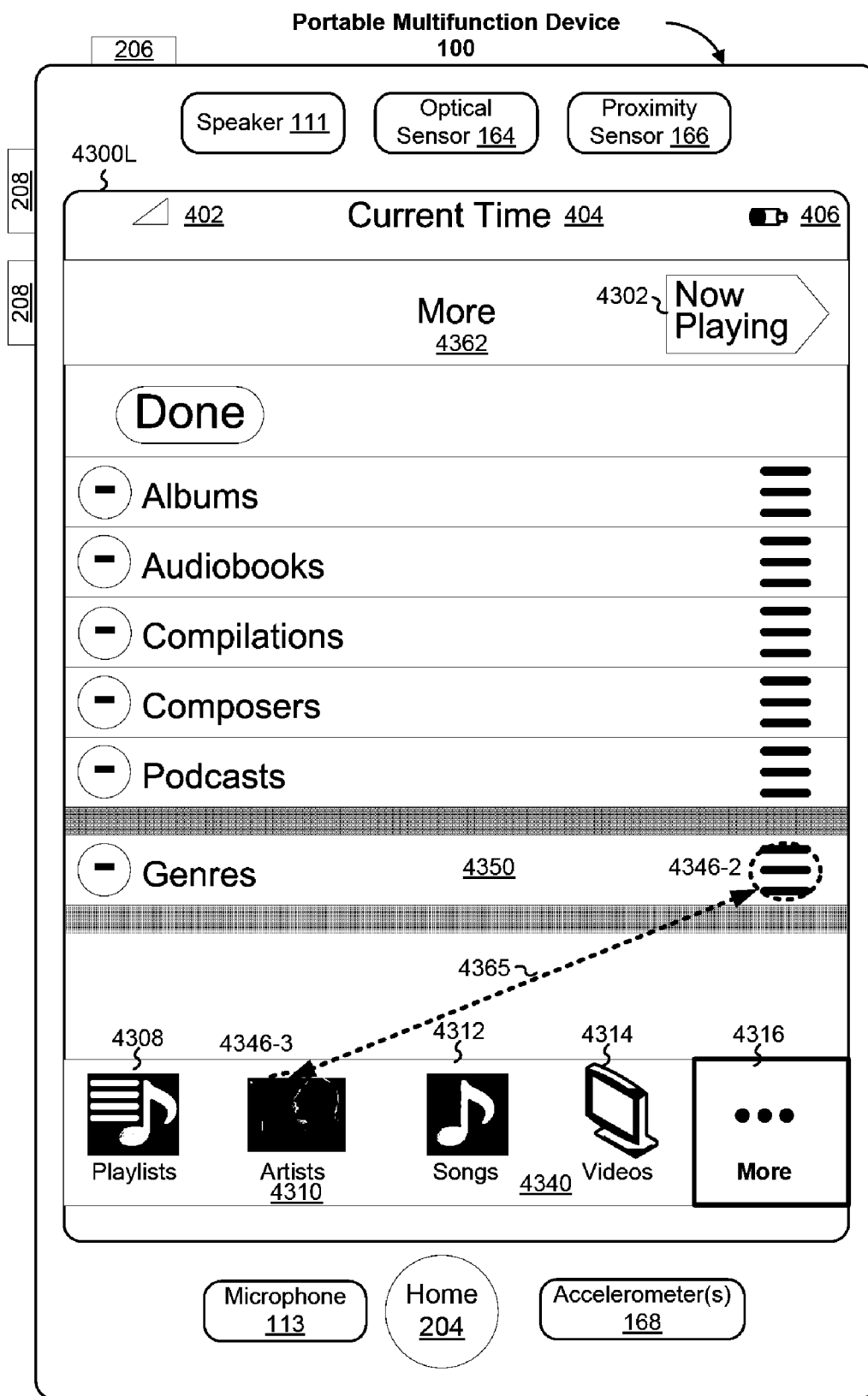


Figure 43L

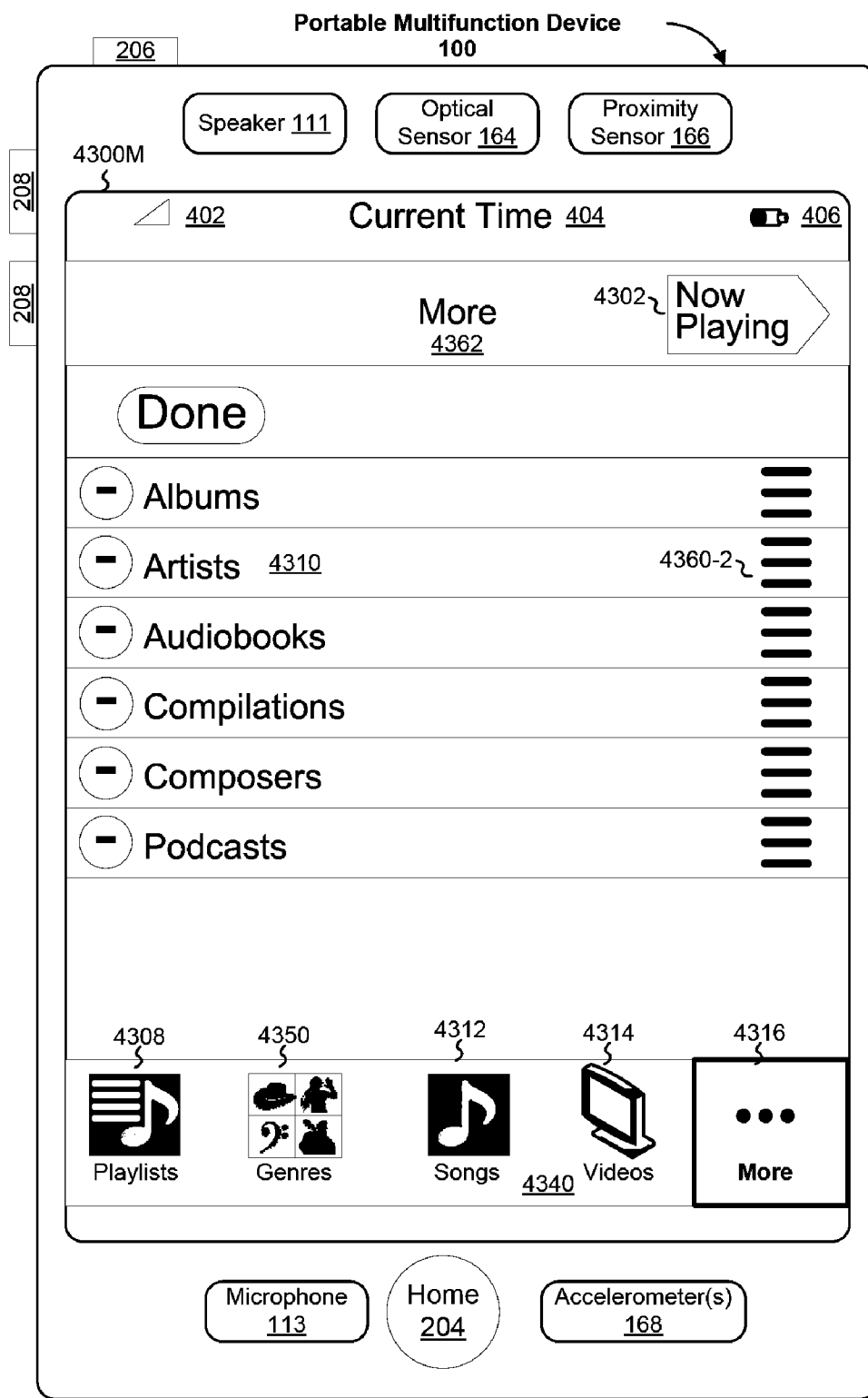


Figure 43M

U.S. Patent

Jan. 20, 2009

Sheet 189 of 293

US 7,479,949 B2

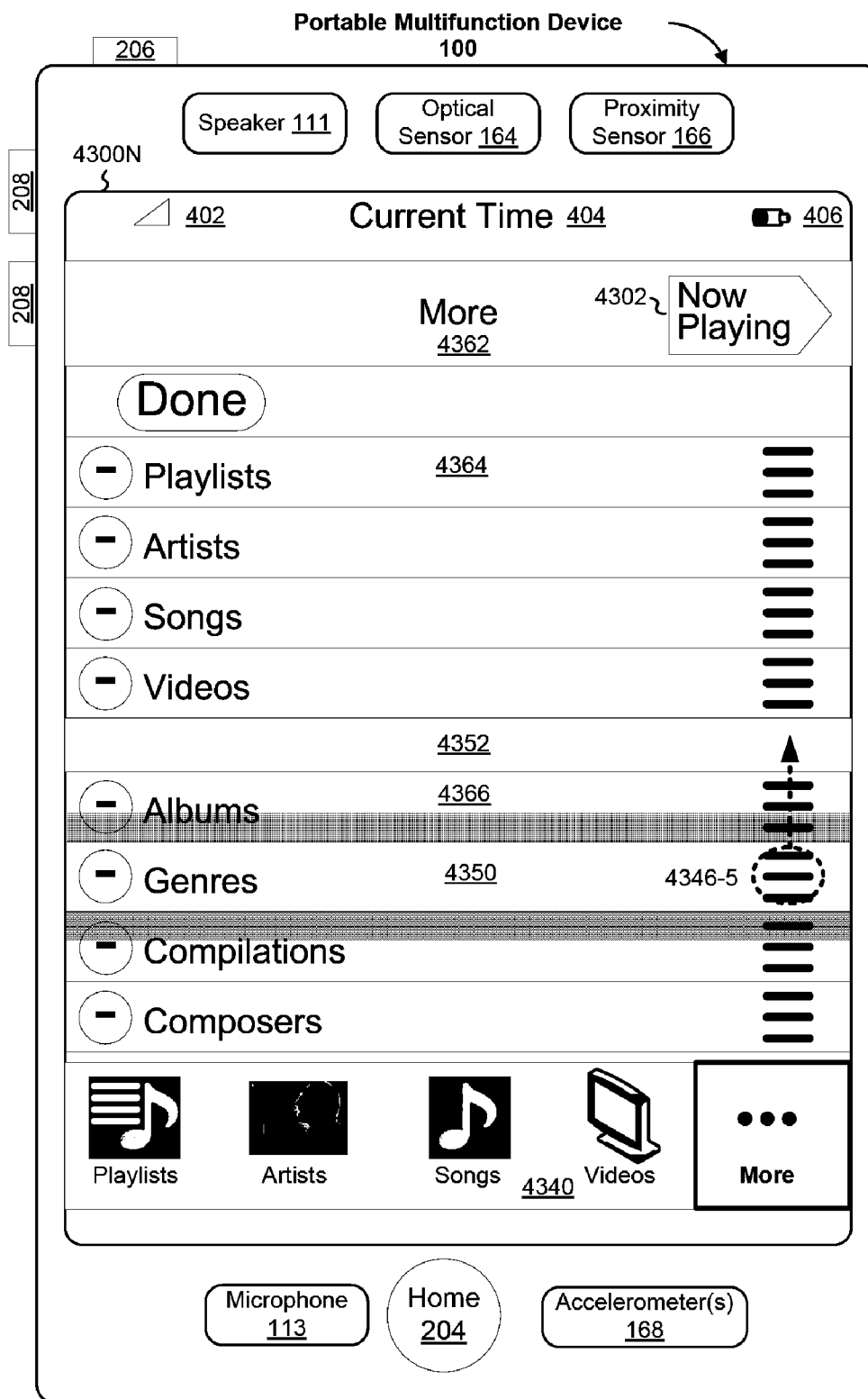


Figure 43N

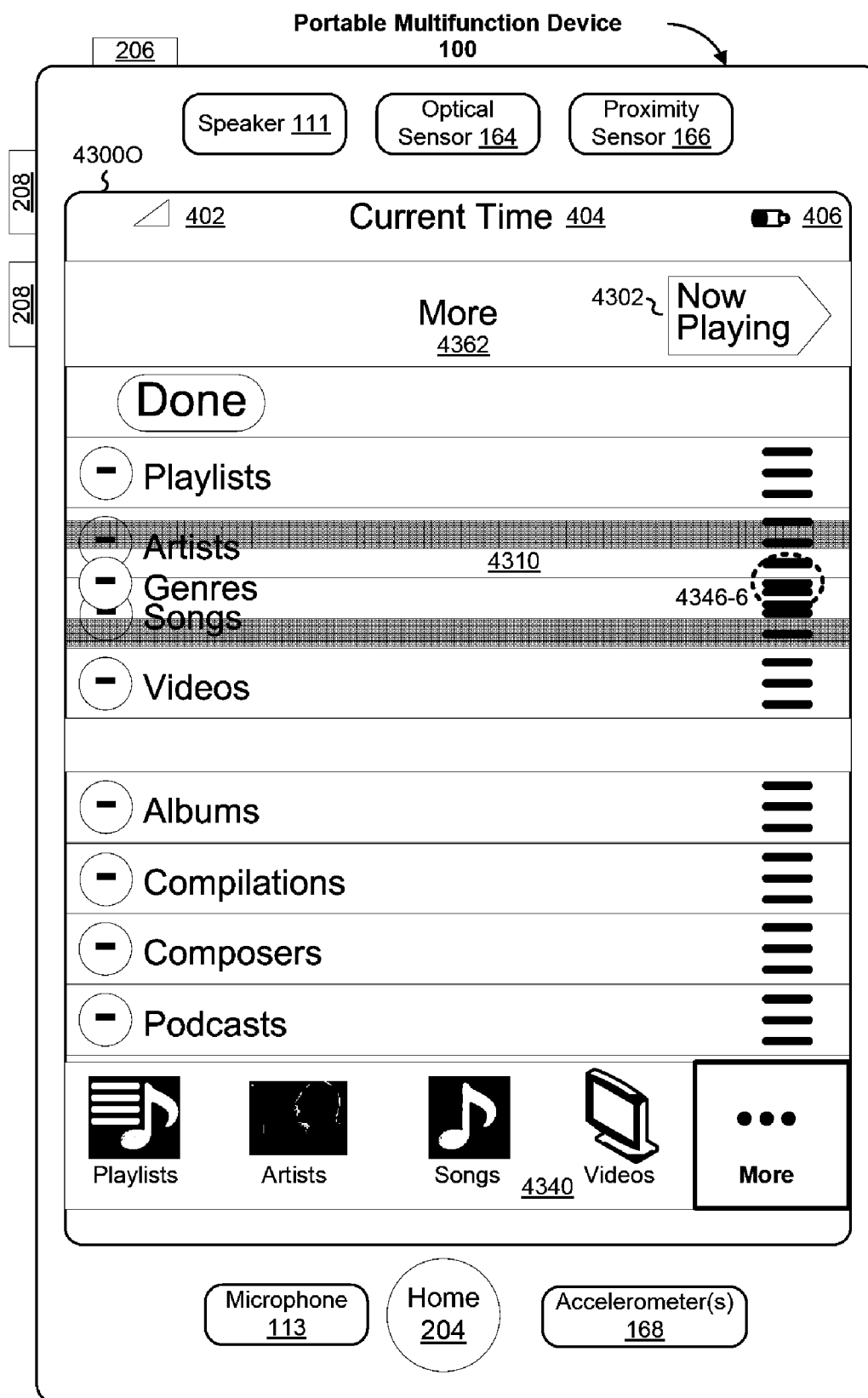


Figure 430

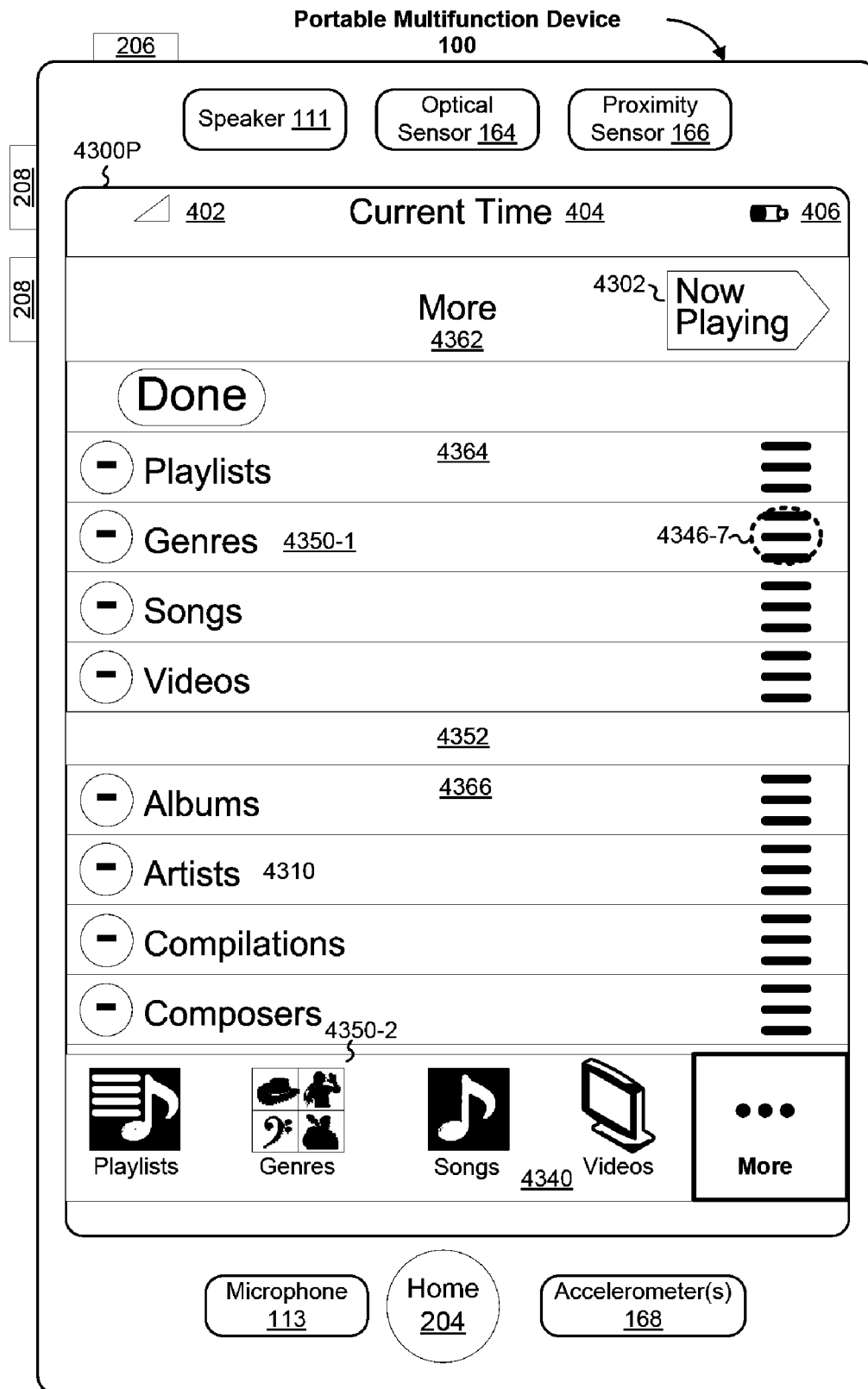


Figure 43P

U.S. Patent

Jan. 20, 2009

Sheet 192 of 293

US 7,479,949 B2

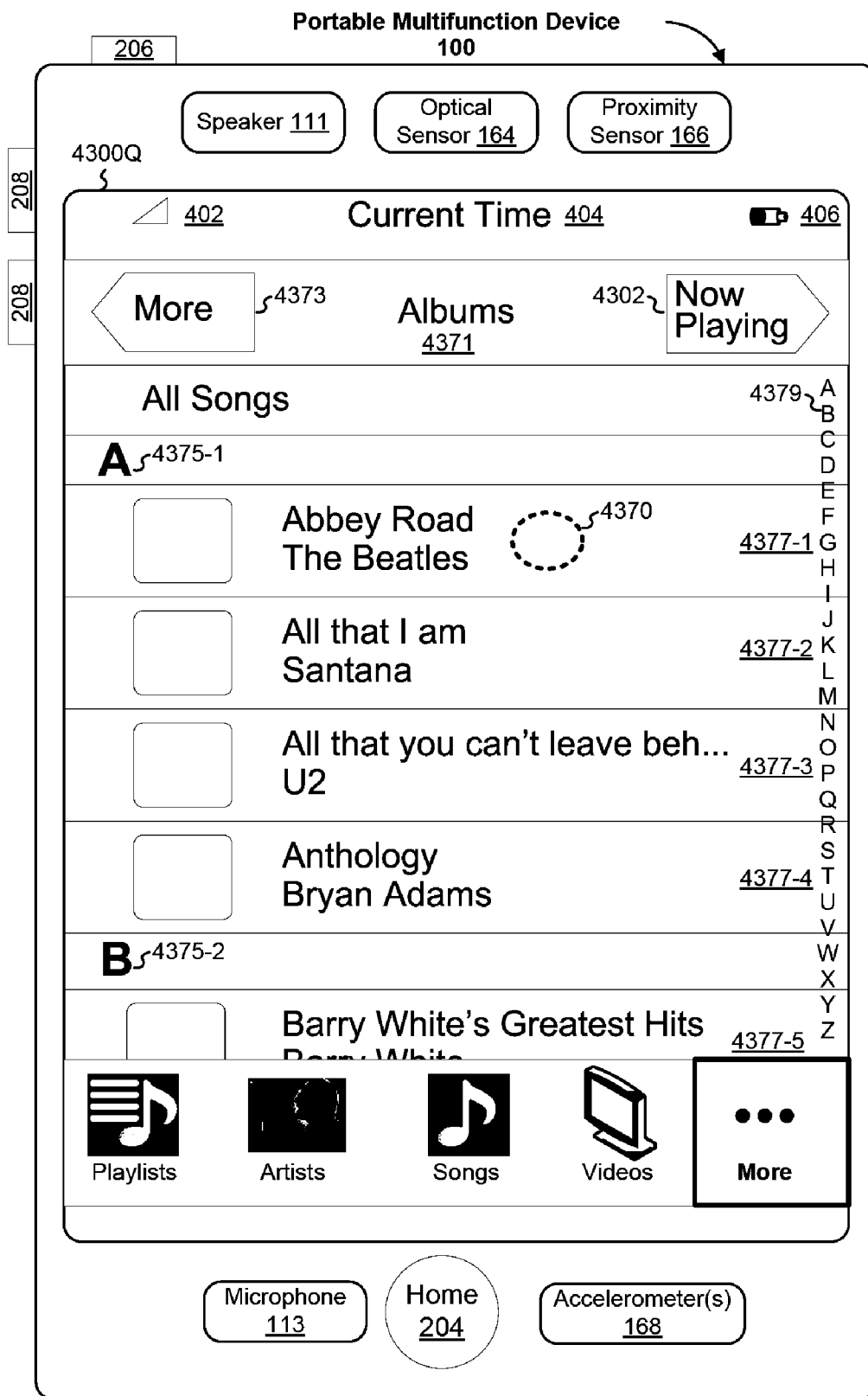


Figure 43Q

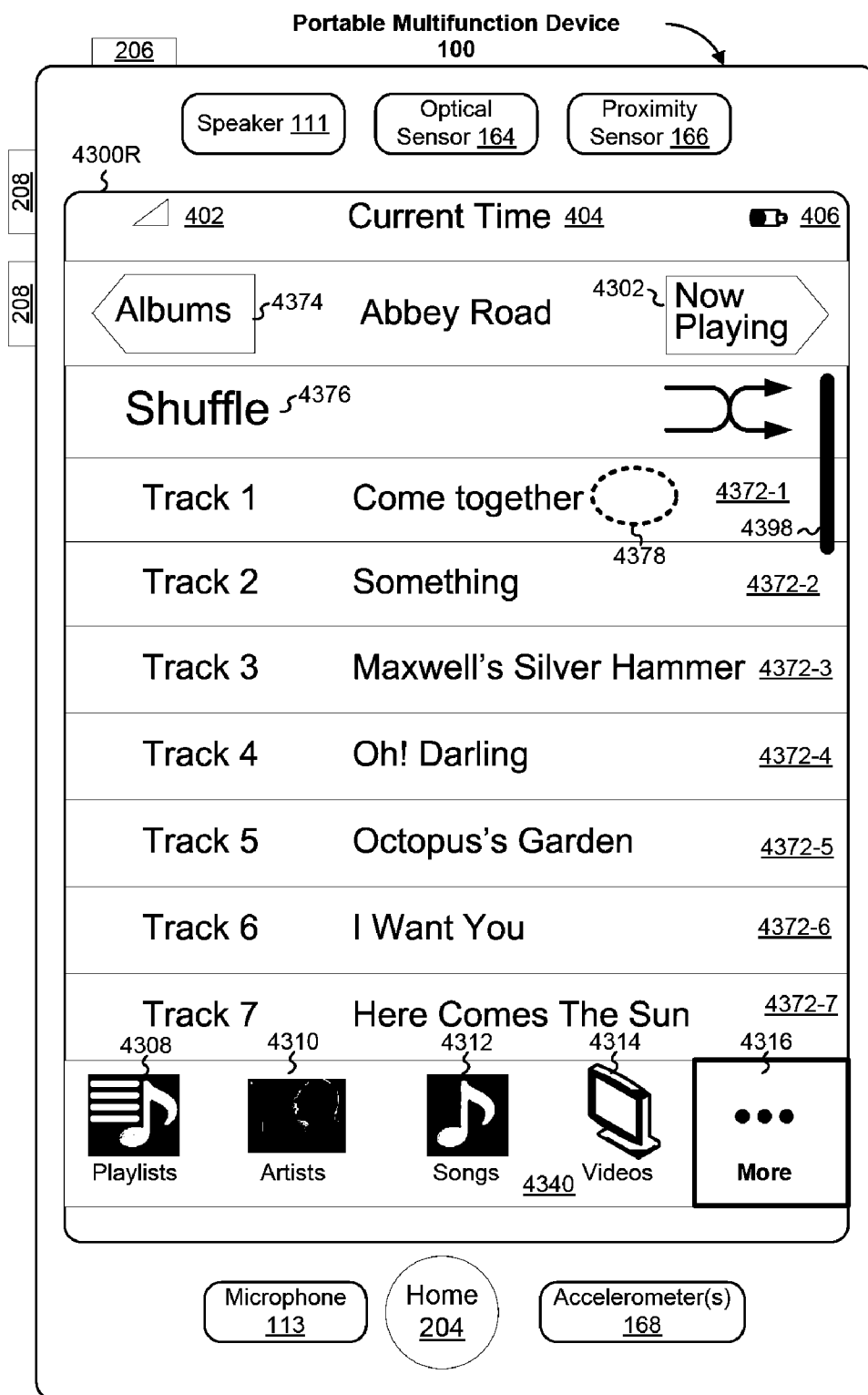


Figure 43R

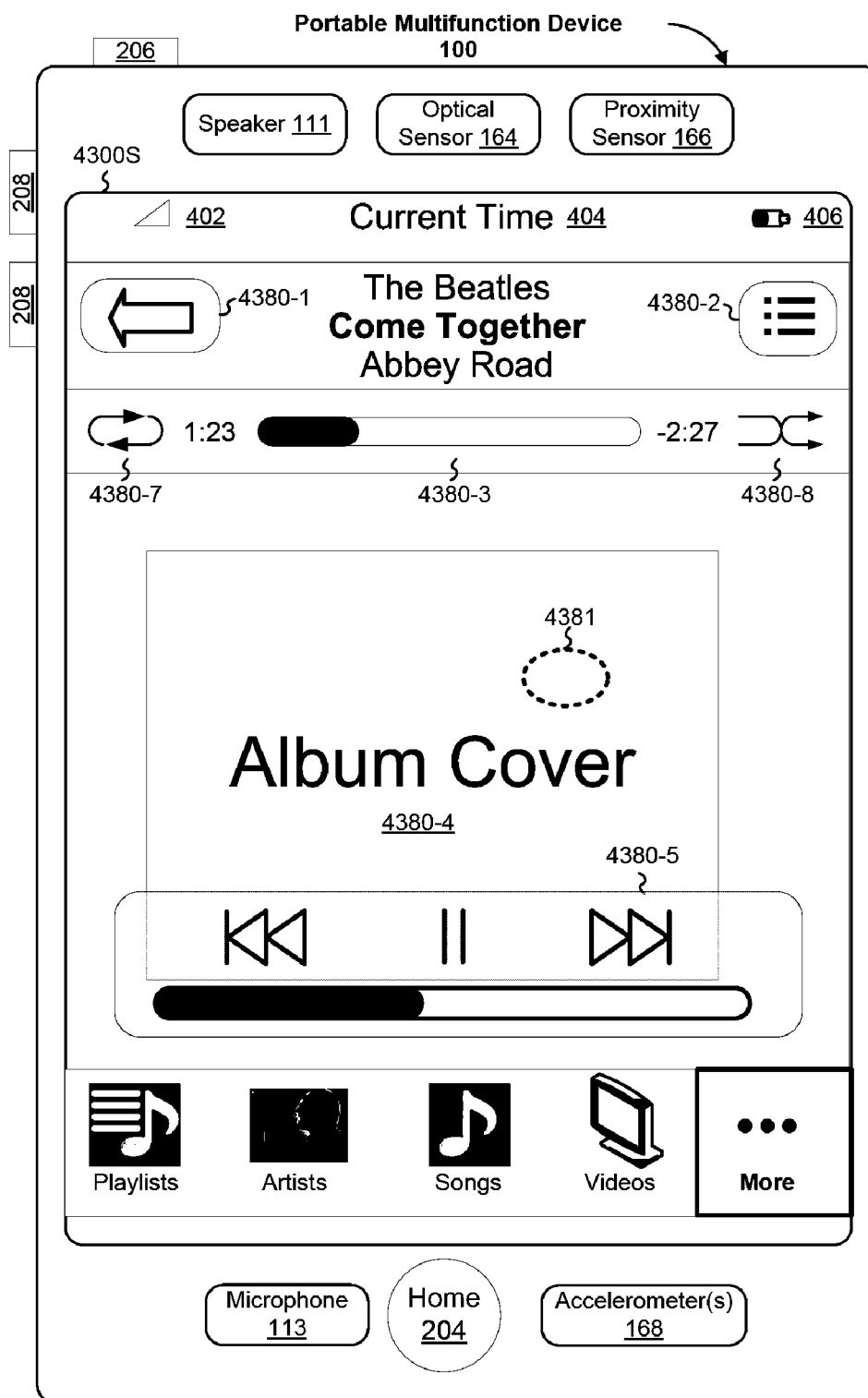


Figure 43S

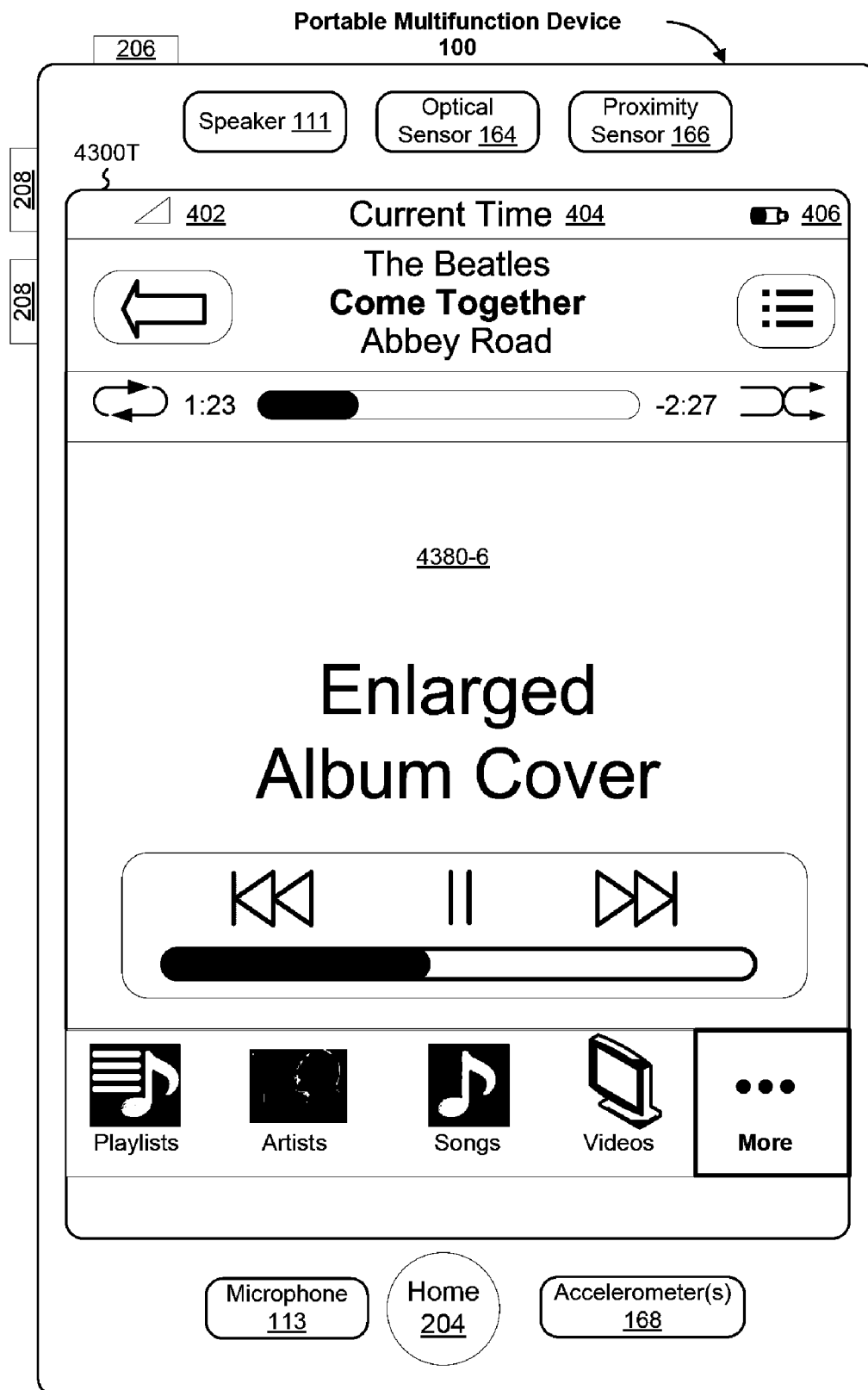


Figure 43T

U.S. Patent

Jan. 20, 2009

Sheet 196 of 293

US 7,479,949 B2

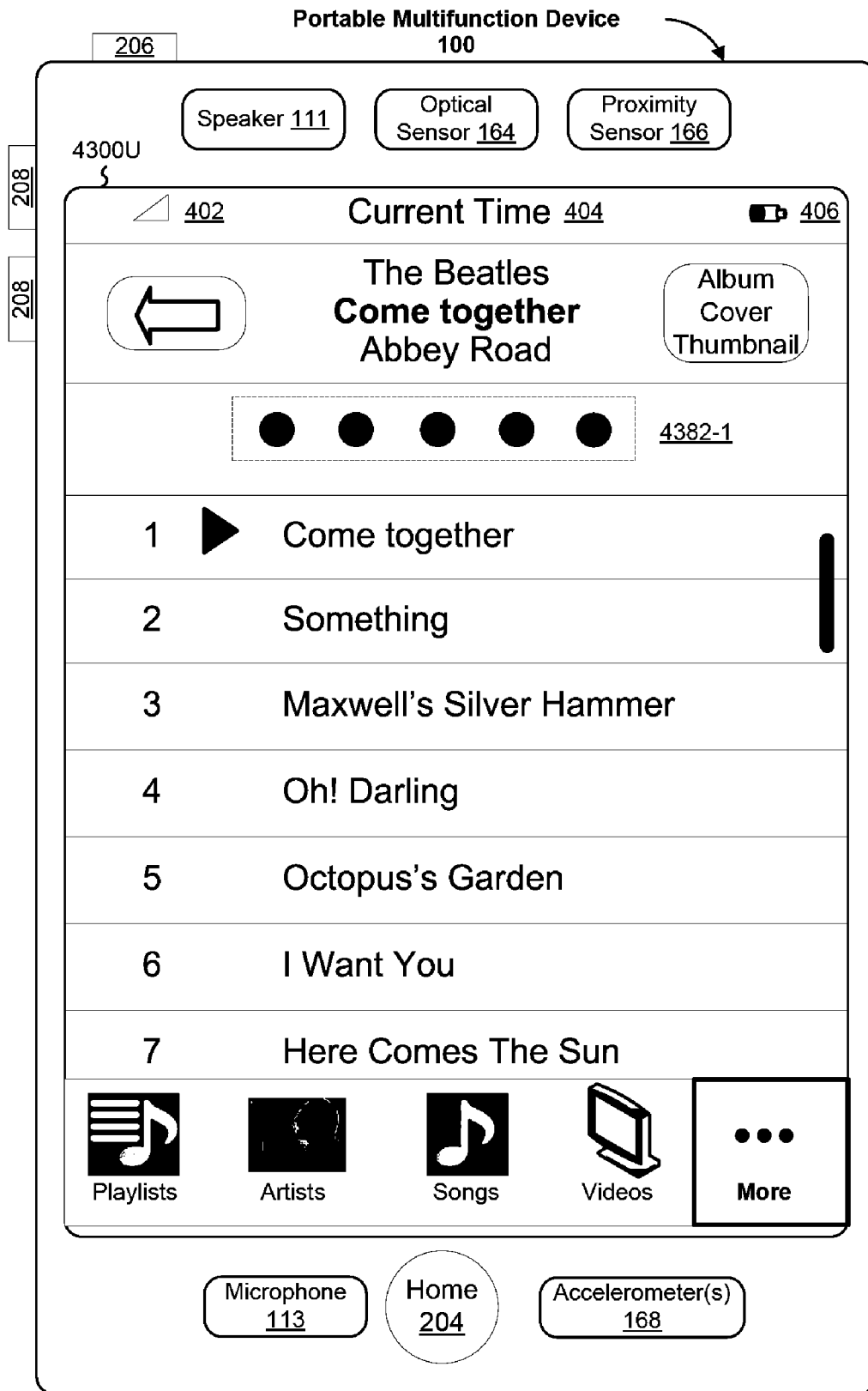


Figure 43U

U.S. Patent

Jan. 20, 2009

Sheet 197 of 293

US 7,479,949 B2



Figure 43V